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Seventh Annual Review and Progress Number

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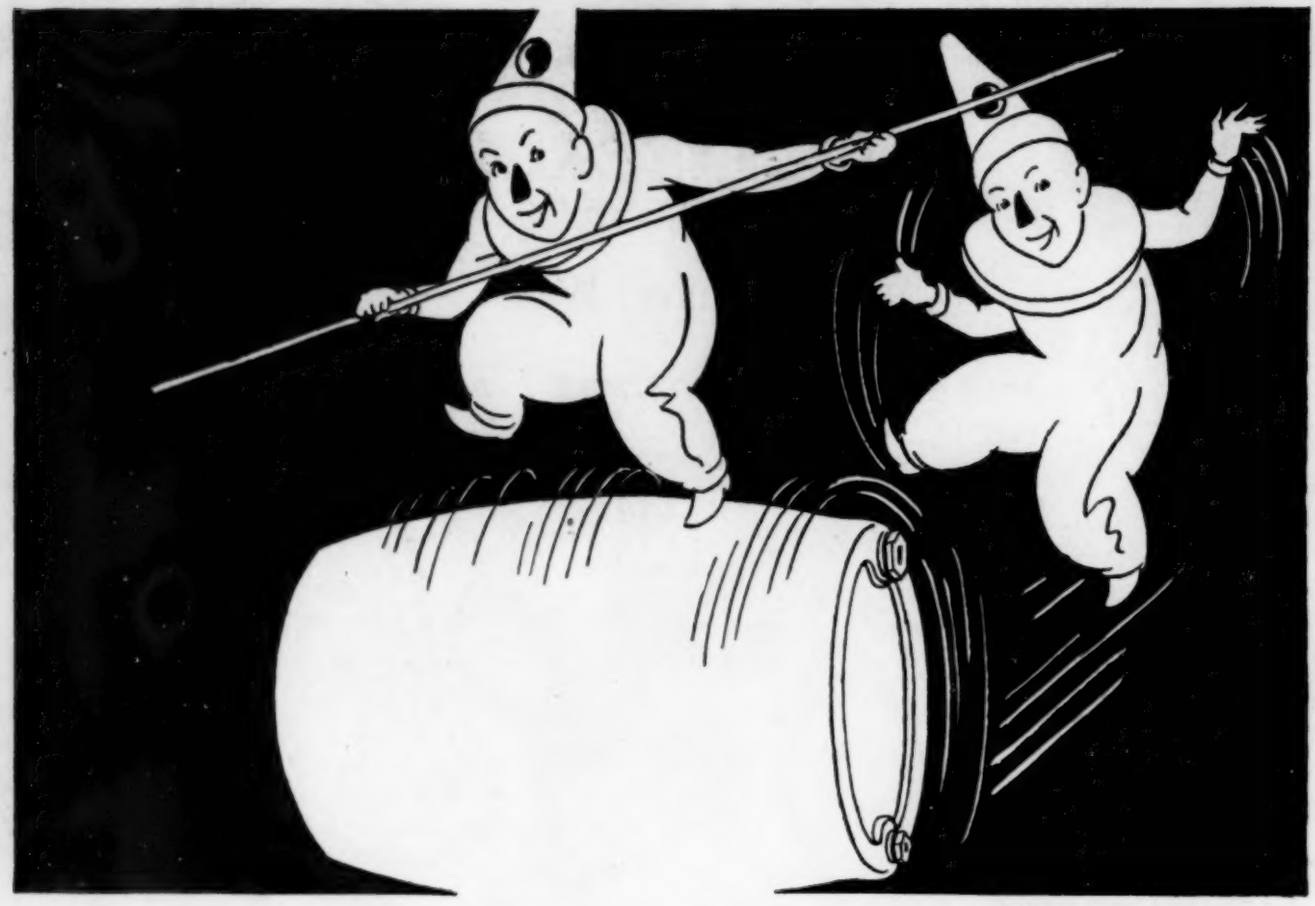

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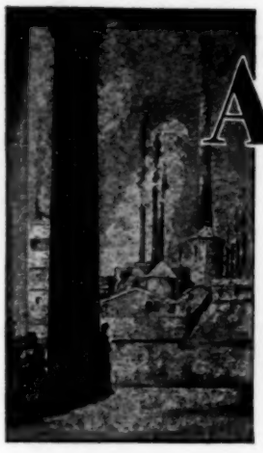
JANUARY, 1930

Vol. 37. No. 1.

X-Raying the STRUCTURE of Industry



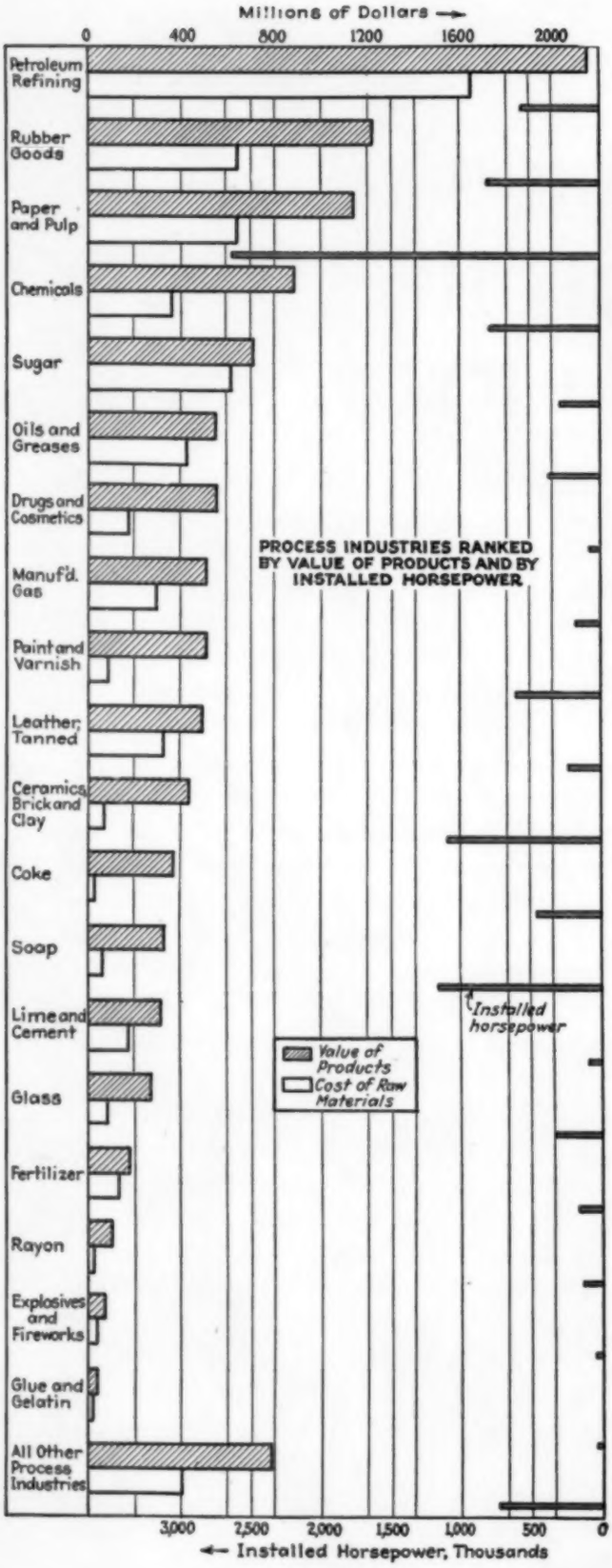
AS ONE looks out upon the broad expanse of chemical engineering in industry, there comes an impression of a remarkable but highly complex and confusing development. Only when we search beneath the surface do we find and appreciate the orderly structure on which the whole of chemical industry has been reared. To turn the X-ray of critical analysis on these economic and technical fundamentals is the purpose of this Seventh Annual Review and Progress Number of *Chem. & Met.*

We are at a crucial period in industry. Every major element must be carefully appraised and then developed to contribute its maximum of strength and efficiency. The stock market's precipitous crash has shown how one factor alone can suddenly disturb and disrupt the whole business structure. In our present study, therefore, it has seemed appropriate to focus major attention on the financial phases of chemical industry—a subject too often neglected in its basic aspects by both technical and non-technical executives. Production, fortunately, is better equipped and more intelligently managed than at any other time in the history of the industry. Yet, here too, the changing structure of technology calls for a responsive and resourceful attitude on the part of management.

Most business failures in chemical industry are not due to the reasons so often cited, viz., inadequate capital, inexperience or ruthless competition. They may usually be traced directly to a lack of accurate information on the fundamentals of production and distribution. There is no scarcity of capital if a proposition is economically and technically sound. Inexperience is not a serious handicap unless it is accompanied by ignorance. Competition can be met if production and marketing methods are right.

Successful industry demands a well-balanced structure. Only when the financial, economic, and technologic factors function in single purpose can we expect the maximum of strength and stability in an industrial enterprise. The present holds an excellent opportunity to co-ordinate and strengthen all of the elements that comprise the fundamental structure of the chemical engineering industries.

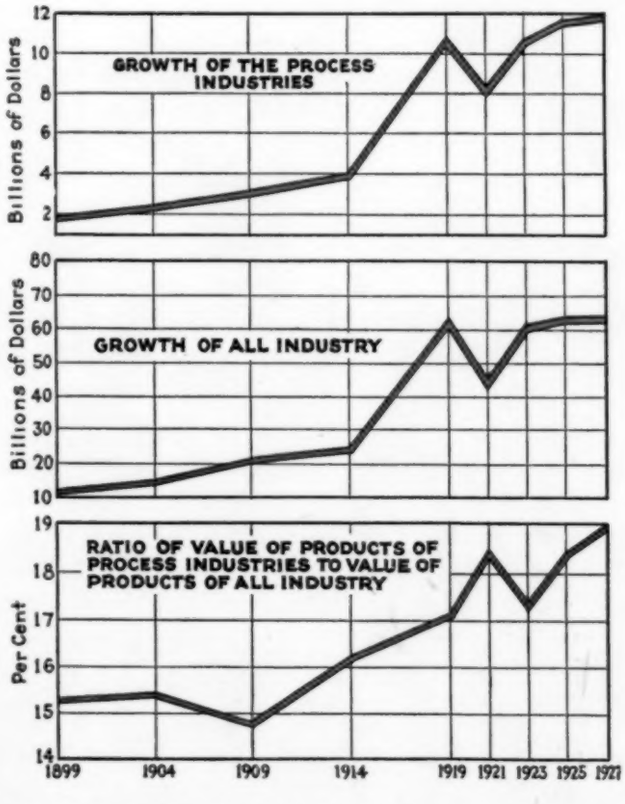
Basic Economic Structure



ESSENTIAL PRODUCTION FIGURES

Industry	Number of Establishments	Number of Wage Earners	Value of Products
Chemicals	2,372	119,684	$884,976,741
Ceramics, Brick and Clay	2,218	138,687	436,103,772
Coke	171	21,082	382,012,617
Drugs, Medicines and Cosmetics	2,385	36,331	559,002,970
Explosives and Fireworks	136	7,367	78,374,607
Fertilizers	621	18,612	190,384,890
Glass	269	65,825	282,394,330
Gelatin, Glue and Adhesives	141	3,728	39,141,210
Leather, tanned	494	52,924	494,255,838
Lime and Cement	421	47,225	335,152,751
Manufactured Gas	828	48,497	516,705,170
Oils and Greases, Animal and Veg.	1,073	30,382	563,848,596
Paints and Varnishes	1,006	28,061	519,009,842
Paper and Pulp	929	123,360	1,138,089,666
Petroleum Refining	354	71,234	2,142,648,503
Rayon	19	26,341	109,888,336
Rubber Goods	516	141,997	1,225,077,114
Soap	597	15,835	328,294,401
Sugar	153	22,369	710,381,336
Other Process Industries	1,876	80,036	792,499,557
Total	16,579	1,099,577	$11,728,242,247

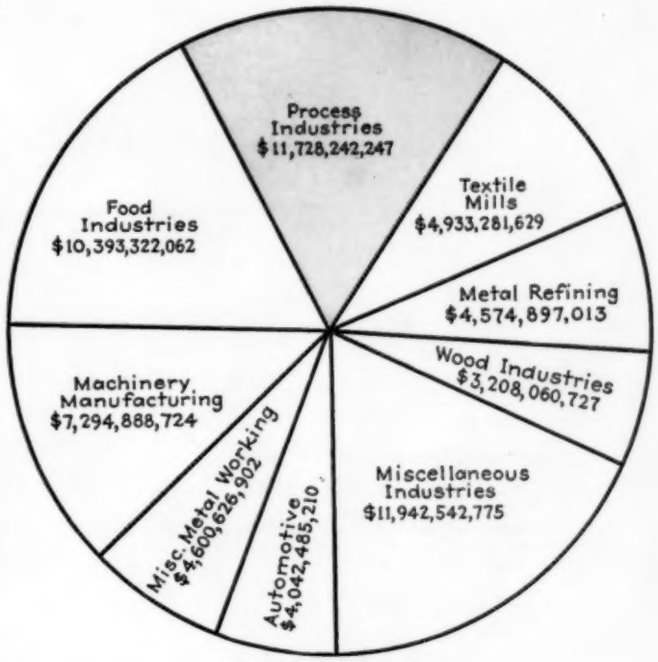
Source: U. S. Census of Manufactures, 1927.



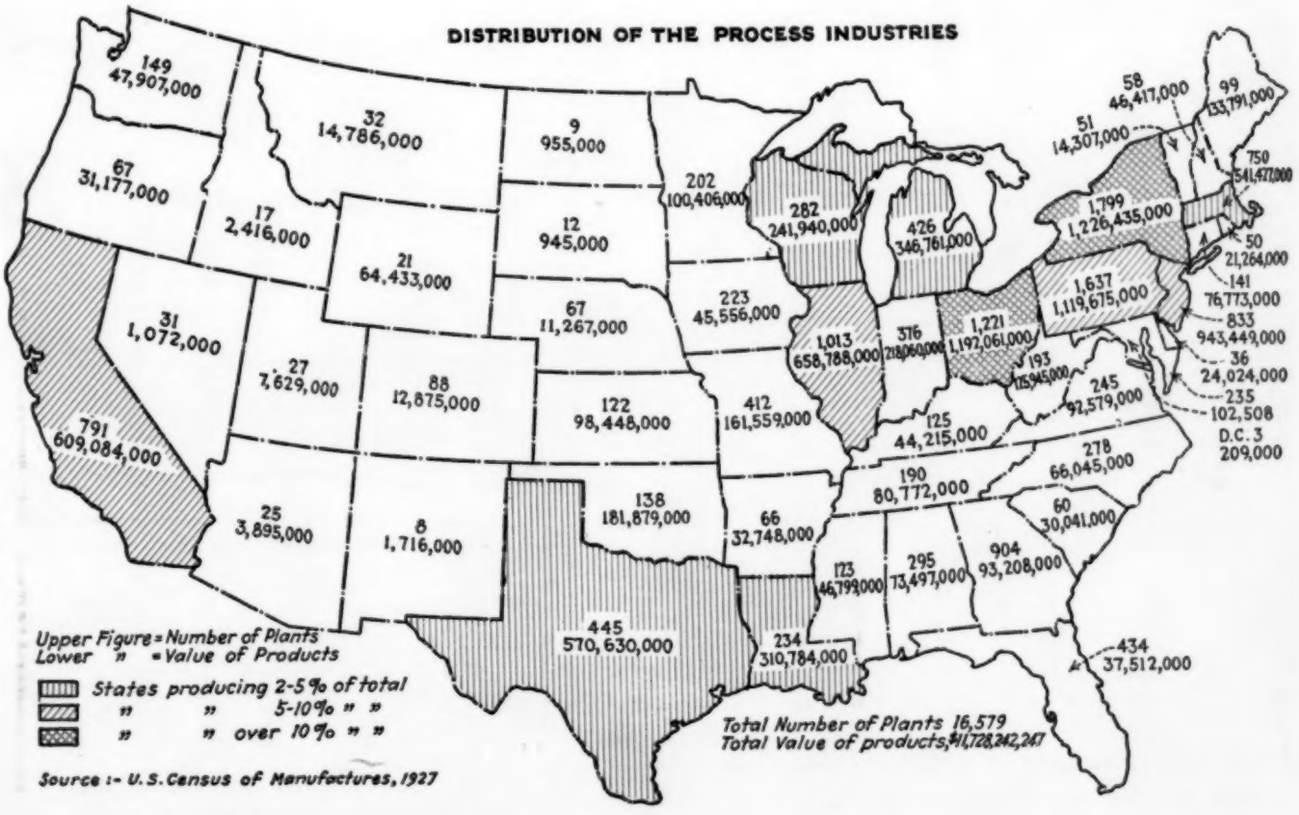
e of the Process Industries

FOR THE PROCESS INDUSTRIES

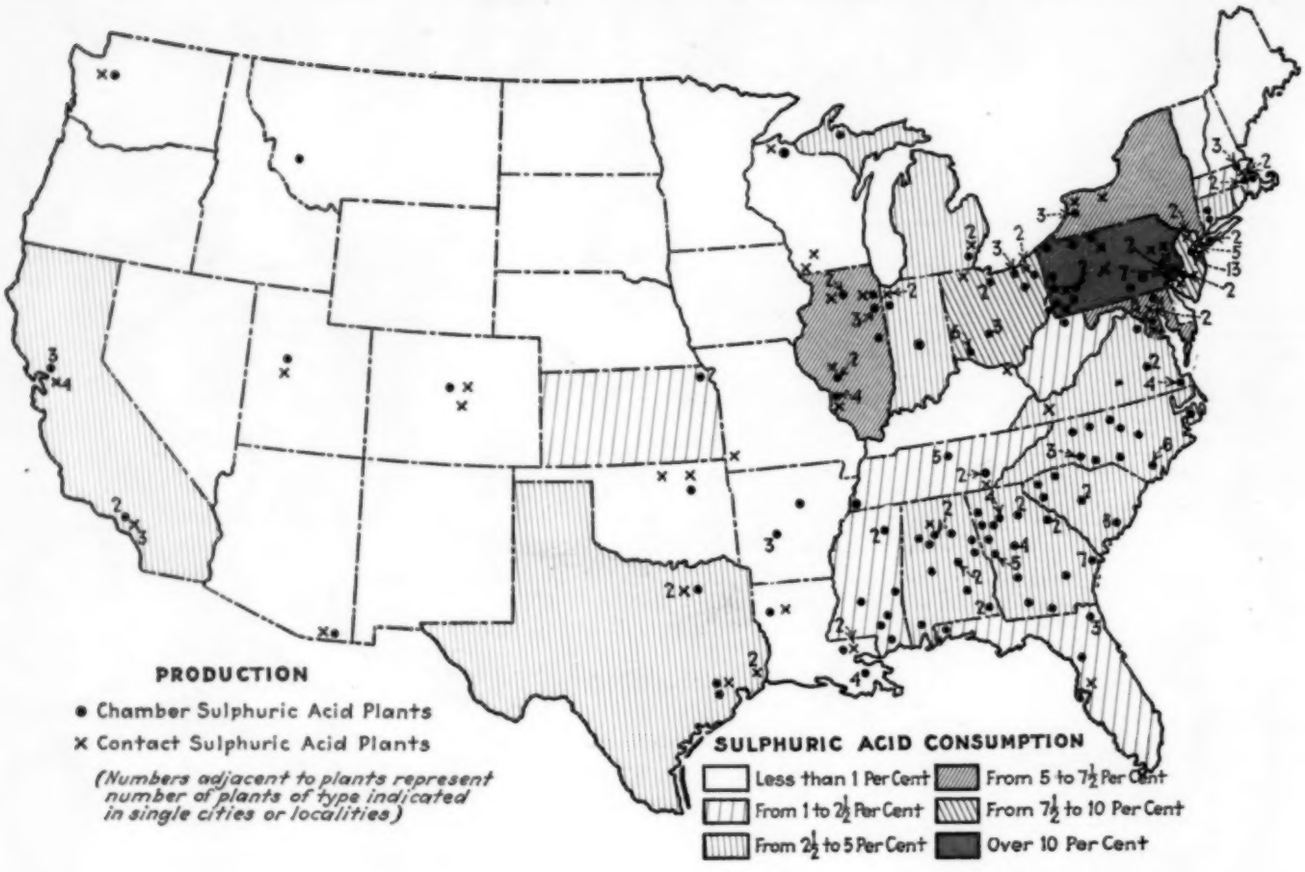
Cost of Materials, Supplies	Cost of Fuel and Power	Value Added by Manufacture	Installed Horsepower
$366,514,044	$55,575,986	$462,886,711	784,017
74,592,819	60,787,765	300,723,188	594,746
27,517,965	259,210,736	95,283,916	451,874
180,818,345	2,770,963	375,413,662	65,094
37,749,971	1,767,277	38,857,359	39,539
135,368,365	2,774,560	52,241,965	156,274
79,441,368	30,470,096	172,482,866	318,298
21,416,371	2,076,374	15,648,465	26,982
324,321,487	7,663,249	162,271,102	220,530
69,185,452	68,096,040	197,871,259	1,153,585
87,249,955	124,535,568	304,919,647	496,014
427,546,715	10,934,351	125,367,530	357,467
300,599,001	7,125,369	211,285,472	163,187
647,167,490	76,943,473	413,978,703	2,642,806
1,649,288,320	103,708,723	389,651,460	552,651
22,743,855	3,003,937	84,140,544	122,406
639,934,922	20,435,287	564,706,905	790,622
183,029,112	4,434,653	140,830,636	70,510
623,244,405	13,197,054	73,939,877	274,707
401,733,106	24,477,932	366,288,519	720,898
$6,299,463,068	$879,989,393	$4,548,789,786	10,177,466



ALL INDUSTRIES
Total $62,718,347,289



Where Heavy Chemicals


PRODUCTION
• Chamber Sulphuric Acid Plants
× Contact Sulphuric Acid Plants
(Numbers adjacent to plants represent number of plants of type indicated in single cities or localities)
SULPHURIC ACID CONSUMPTION
Less than 1 Per Cent
From 1 to 2½ Per Cent
From 2½ to 5 Per Cent
From 5 to 7½ Per Cent
From 7½ to 10 Per Cent
Over 10 Per Cent

Sulphuric Acid Plants, Production and Consumption by States, 1929

State	Sulphuric Acid Plants[1]		Per Cent[2] U.S. Production (Estimated)	Per Cent[2] U.S. Consumption (Estimated)
	Chamber	Contact		
Alabama	14	1	2.35	3.66
Arizona	1	1	[3]	0.22
Arkansas	4	1	0.51	0.10
California	6	6	4.70	4.55
Colorado	1	2	0.51	0.48
Connecticut	2	.....	[3]	3.05
Delaware	.....	1	[3]	0.12
Florida	5	1	0.86	1.52
Georgia	32	.....	3.34	4.87
Illinois	13	4	8.20	5.71
Indiana	2	2	1.89	4.73
Iowa	.....	.....	.....	0.11
Kansas	1	.....	[3]	1.00
Kentucky	.....	1	[3]	0.28
Louisiana	6	3	1.26	2.09
Maine	.....	.....	.....	0.15
Maryland	10	3	8.70	6.39
Massachusetts	6	2	3.53	2.32
Michigan	2	2	0.88	2.59
Minnesota	7	.....	0.76	0.30
Mississippi	.....	1	[3]	0.57
Missouri	.....	1	[3]	0.98
Montana	1	.....	[3]	0.05
Nebraska	.....	.....	.....	0.06
New Hampshire	.....	.....	.....	0.13
New Jersey	15	8	11.98	8.34
New Mexico	.....	.....	.....	0.04
New York	5	2	2.27	7.29
North Carolina	17	.....	2.39	3.31
Ohio	16	3	7.20	8.43
Oklahoma	1	2	1.02	0.07
Oregon	.....	.....	.....	0.01
Pennsylvania	17	8	11.70	10.79
Rhode Island	.....	.....	.....	0.34
South Carolina	13	.....	2.15	2.92
Tennessee	8	1	7.83	1.20
Texas	3	5	3.91	4.56
Utah	1	1	[3]	0.10
Vermont	.....	.....	.....	0.07
Virginia	8	1	2.90	3.51
Washington	1	1	[3]	0.19
West Virginia	2	.....	[3]	1.31
Wisconsin	1	3	0.25	0.75
Wyoming	.....	.....	.....	0.73
Undistributed	.....	.....	8.91	.....
Total	221	67	100.00	100.00

[1] When both chamber and contact units are in operation at single plants, the units are listed separately as separate plants.

[2] Production and consumption percentages are recommended for comparison purposes and rough calculations only. Although these estimates are believed to be correct within 10 to 15 per cent, reliable sources for these data are not available.

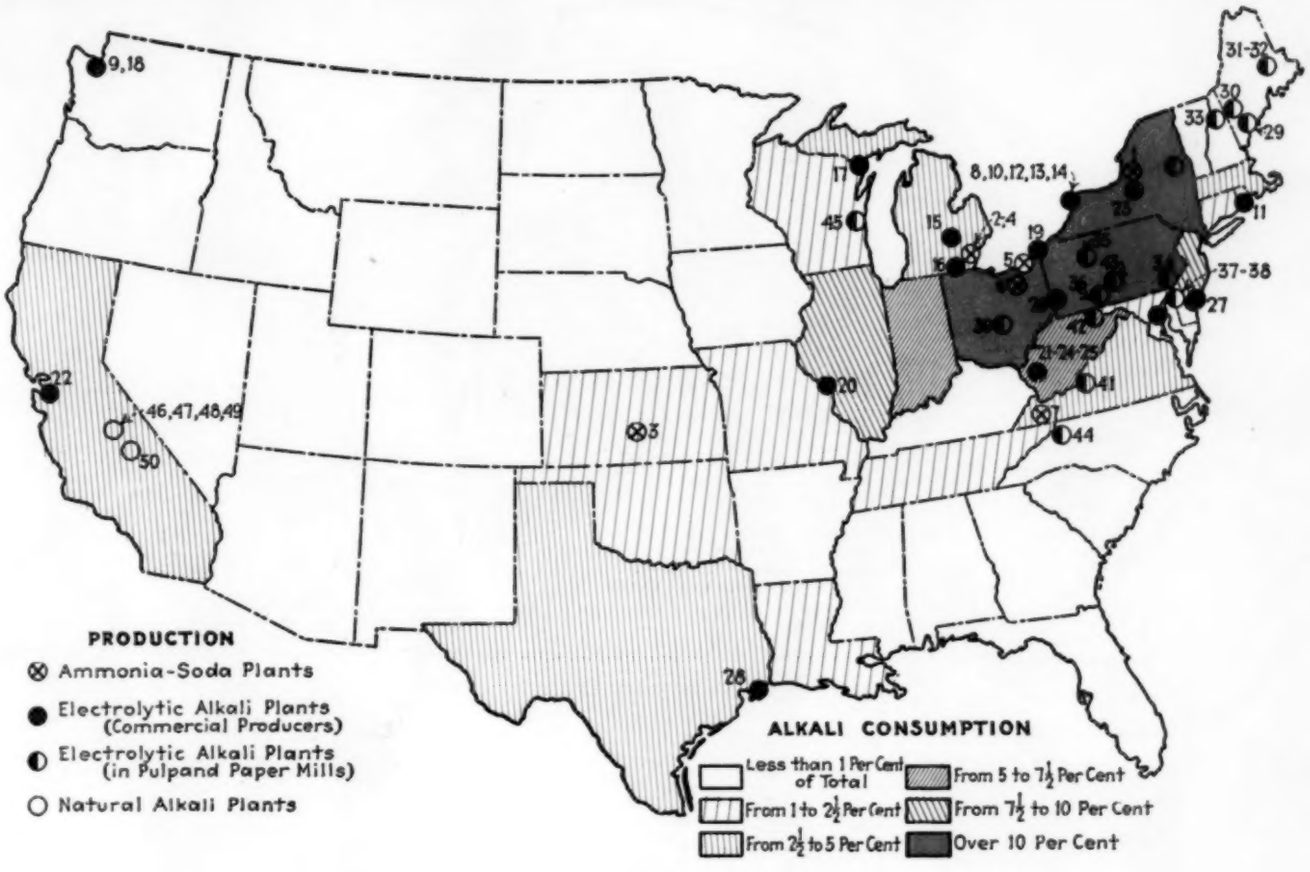
[3] Production percentages for states having two or less sulphuric acid plants are lumped in the undistributed total.

Estimated Distribution of 50° Bé. Sulphuric Acid

Consuming Industries	1927 Tons	1928 Tons	1929 Tons
Fertilizers	1,925,000	2,300,000	2,360,000
Petroleum Refining	1,325,000	1,350,000	1,570,000
Chemicals	725,000	745,000	820,000
Coal Products	732,000	740,000	820,000
Iron and Steel	685,000	670,000	770,000
Other Metallurgical	700,000	570,000	625,000
Paints and Pigments	210,000	205,000	215,000
Explosives	183,000	170,000	195,000
Textiles	135,000	78,000	85,000
Rayon	(Not shown)	105,000	145,000
Miscellaneous	290,000	292,000	320,000
Total	6,935,000	7,225,000	7,925,000

Editor's Note—*A tabulation of sulphuric acid plants by states, giving locations and types of plants, appears on page 50 of this issue.*

Are Made and Consumed



Alkali Producing Plants in the United States, 1930

Ammonia-Soda Alkali Plants

1-3. Solvay Process Co., Syracuse, N. Y., Detroit, Mich. and Hutchinson, Kan. (not operating)
4. Michigan Alkali Co., Wyandotte, Mich.
5. Diamond Alkali Co., Painesville, Ohio.
6. Columbia Chemical Co., Barberton, Ohio.
7. Mathieson Alkali Co., Saltville, Va.

Electrolytic Alkali Plants—Commercial Producers

8. Hooker Electrochemical Co., Niagara Falls, N. Y.
9. Hooker Electrochemical Co., Tacoma, Wash.
10. Mathieson Alkali Works, Niagara Falls, N. Y.
11. Mathieson Alkali Works, Providence, R. I.
12. Niagara Alkali Co., Niagara Falls, N. Y.
13. Isco Chemical Co., Niagara Falls, N. Y.
14. Niagara Smelting Corp., Niagara Falls, N. Y.
15. Dow Chemical Co., Midland, Mich.
16-18. Pennsylvania Salt Manufacturing Co., Wyandotte, Mich., Menominee, Mich. and Tacoma, Wash.
19. Diamond Alkali Co., Painesville, Ohio.
20. Monsanto Chemical Works, East St. Louis, Ill.
21. Monsanto Chemical Works, Nitro, W. Va.
22. Great Western Electrochemical Co., Pittsburg, Calif.
23. Solvay Process Co., Syracuse, N. Y.
24. Belle Alkali Co., Belle, W. Va.
25. Westvaco Chlorine Products Co., So. Charleston, W. Va.
26. Vulcan Detinning Co., Pittsburgh, Pa.
27. E. I. duPont de Nemours & Co., Deepwater Point, N. J.
28. Gulf Refining Co., Port Arthur, Texas.

Electrolytic Alkali Plants—Pulp and Paper Mills

29. S. D. Warren & Co., Cumberland, Me.
30. Oxford Paper Co., Rumford, Me.
31. Eastern Manufacturing Co., South Brewer, Me.
32. Penobscot Chemical Fibre Co., Great Works, Me.
33. The Brown Co., Berlin, N. H.
34. Dill and Collins, Philadelphia, Pa.
35. New York & Pennsylvania Paper Co., Johnsonburg, Pa.
36. D. M. Bare Paper Co., Roaring Springs, Pa.
37. Jessup and Moore Paper Co., Wilmington, Del.
38. Jessup and Moore Paper Co., Elkton, Md.
39. Miami Paper Co., Carrollton, Ohio.
40-43. West Virginia Pulp & Paper Co., Mechanicville, N. Y., Covington, Va., Luke, Md. and Tyrone, Pa.
44. Champion Fibre Co., Canton, N. C.
45. Kimberly-Clark Co., Kimberly, Wis.

Natural Alkali Plants

46. The Clark Chemical Co., Lone Pine, Calif.
47. Inyo Chemical Co., Lone Pine, Calif.
48. Natural Soda Products Co., Keeler, Calif.
49. Kuhnert Syndicate, Bartlett, Calif.
50. Westend Chemical Co., Westend, Calif.

Estimated Distribution of Soda Ash

Consuming Industries	1928 Tons	1929 Tons
Glass Works	620,000	672,000
Soap	210,000	213,000
Chemicals	225,000	335,000
Cleansers and Modified	130,000	125,000
Pulp and Paper	100,000	110,000
Water Softeners	63,000	60,000
Petroleum Refining	23,000	26,000
Textiles	36,000	40,000
Exports	30,000	40,000
Miscellaneous	45,000	47,000
Total	1,482,000	1,668,000

These annual distribution studies are based on confidential information furnished by the producers and consumers of heavy chemicals. They are the copyrighted property of *Chem. & Met.* but permission for their republication with proper credit will be willingly given.

Estimated Distribution of Caustic Soda

Consuming Industries	1928 Tons	1929 Tons
Soap	97,000	103,000
Chemicals	82,500	90,000
Petroleum Refining	98,000	116,000
Rayon	82,00	105,000
Lye	32,000	25,000
Exports	59,000	62,000
Textiles	37,500	40,500
Rubber Reclaiming	35,000	40,000
Vegetable Oils	11,000	11,000
Pulp and Paper	33,000	37,000
Miscellaneous	31,000	33,000
Total	598,000	662,500

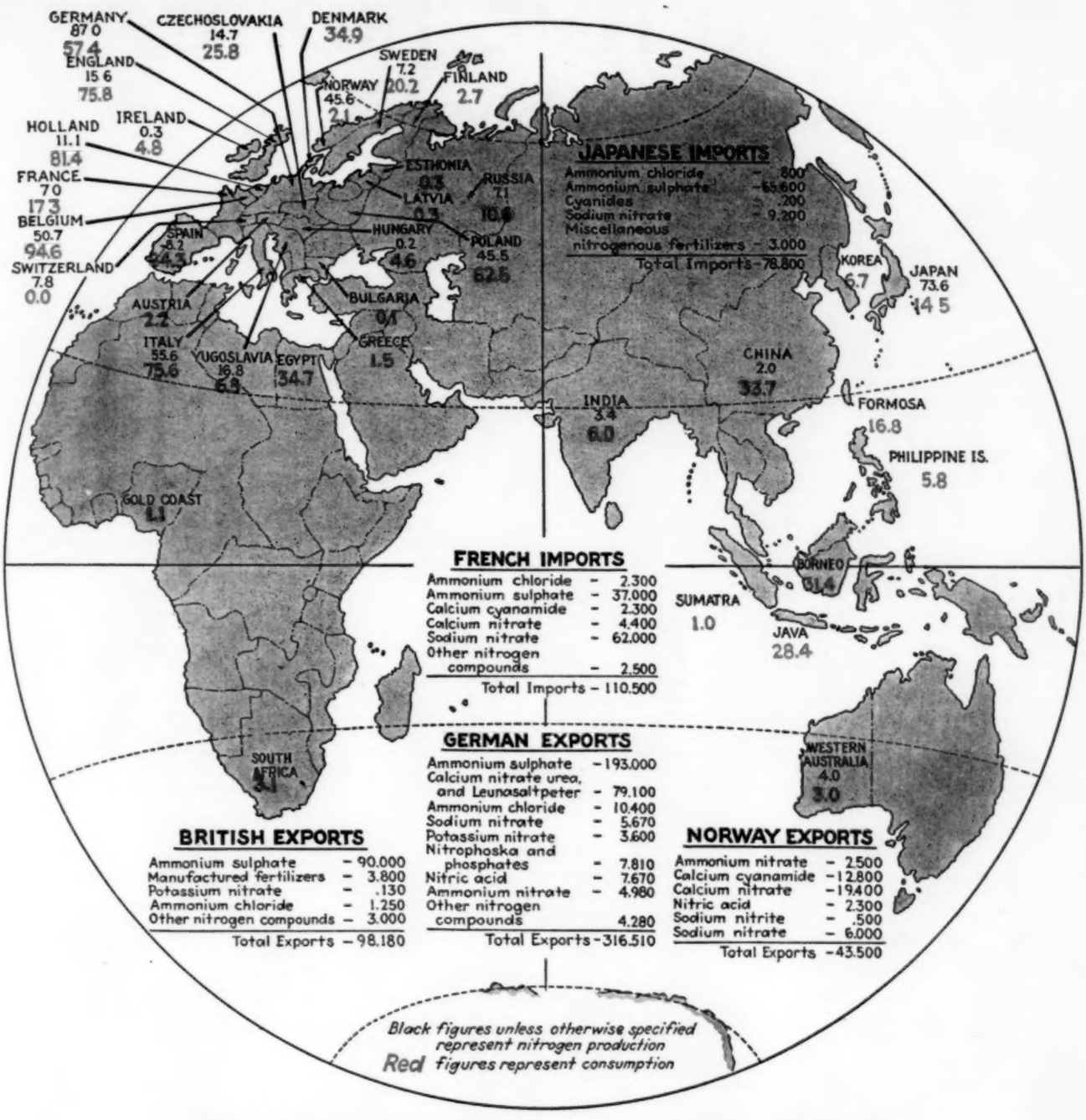
Nitrogen From a

World Nitrogen Statistics for the year ended Dec. 31, 1928

(In thousands of short tons of nitrogen)

Country	Production	Imports	Exports	Apparent Consumption	Country	Production	Imports	Exports	Apparent Consumption
Germany	870.0	20.8	316.5	574.3	Korea	.....	6.7	.....	6.7
United States	198.0	268.6	35.4	431.2	Hawaiian Islands	.....	10.2	.....	10.2
France	70.0	110.5	7.2	173.3	U. S. S. R.	7.1	3.5	.....	10.6
Japan	73.6	78.8	7.3	145.1	Jugo Slavia	16.8	0.9	11.2	6.5
Belgium	50.4	50.4	6.2	94.6	India & Ceylon	3.4	4.8	2.2	6.0
United Kingdom	156.0	18.0	98.2	75.8	Philippine Islands	.....	5.8	.....	5.8
Italy	55.6	24.9	4.9	75.6	Irish Free State	0.3	4.7	0.2	4.8
Netherlands	11.1	81.8	11.5	81.4	New Zealand	.....	4.4	.....	4.4
Spain	8.2	56.1	.....	64.3	Hungary	0.2	4.4	.....	4.6
Poland	45.5	21.3	4.3	62.5	Cuba	.....	3.4	.....	3.4
Egypt	.....	34.7	.....	34.7	South Africa	.....	3.1	.....	3.1
Denmark	.....	34.9	.....	34.9	Canary Islands	.....	3.4	.....	3.4
Java	.....	28.4	.....	28.4	Australia	4.0	.....	1.0	3.0
Dutch East Indies	.....	31.4	.....	31.4	Finland	.....	2.7	.....	2.7
China	2.0	33.8	2.1	33.7	British West Indies	.....	4.6	.....	4.6
Czechoslovakia	14.7	12.0	0.9	25.8	Norway	45.6	.....	43.5	2.1
Sweden	7.2	13.2	0.2	20.2	Austria	.....	3.8	1.6	2.2
Formosa	.....	16.8	.....	16.8	Greece	.....	1.5	.....	1.5
Canada	42.9	9.5	35.4	17.0	Brazil	.....	0.7	.....	0.7

World Viewpoint



World Nitrogen Statistics for the year ended Dec. 31, 1928

(In thousands of short tons of nitrogen)

Country	Production	Imports	Exports	Apparent Consumption
French West Africa		1.1		1.1
East Coast Sumatra		1.0		1.0
Peru		1.0		1.0
Fiji		0.6		0.6
Chile	553.0	0.0	489.0	[1]0.0
West Indies (Except Cuba & Bermuda)		0.3		0.3
Barbados		0.1		0.1
Esthonia		0.3		0.3
Latvia		0.3		0.3
Newfoundland		0.2		0.2
Argentina		0.2		0.2
Switzerland	7.8	1.5	9.3	0.0
Bulgaria		0.1		0.1
Manchuria				
Mexico				
Totals	2,243.4	1,021.2	1,088.1	2,112.5

[1] Stocks on hand Dec. 31 in Chile were equivalent to 161,000 short tons of nitrogen.

Note: In computing apparent consumption, stocks on hand are not taken into account. The consumption of nitrogen in Germany is probably somewhat less than that indicated because of the large stocks of ammonium sulphate. Furthermore, there were unconsumed stocks of Chile nitrate in numerous countries on Dec. 31 1928.

Acknowledgment

These maps and the data on which they are based are the result of a compilation made for *Chem. & Met.* by Messrs. Howard P. Emerson and Edward T. Dunn, of the DuPont Ammonia Corporation, of Wilmington, Del. The original outline maps of the Eastern and Western Hemispheres used in this tabulation are those of Rand McNally & Company, of Chicago, Ill.

LONG-TIME TRENDS

in Chemical Producing and Consuming Industries

EDITOR'S NOTE—In connection with his accompanying study of the financial structure of American chemical industry, Dr. Theodore M. Switz, of the Investment Research Corporation, has prepared the following comment and charts showing the past and prospective rates of growth of chemical-producing and consuming industries.

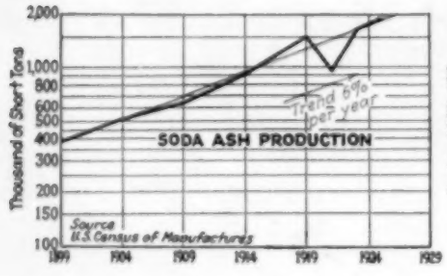
* * *

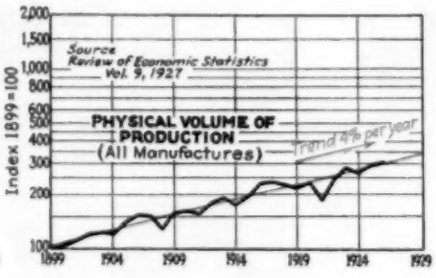
SINCE chemical products may be considered as "raw materials of raw materials" and are widely distributed throughout industry, their consumption should increase at least as rapidly as the physical volume of production of all manufactures. The chart below shows that American manufactures have grown very steadily at the rate of 4 per cent per year throughout the period 1900-1926. The textile industry, an important consumer of chemicals of all kinds, shows considerable fluctuations around an average increase of 1 per cent per year during the period 1913-1928. Fertilizer production increased quite rapidly from 1900 to 1914, but since then has grown only about 1 per cent per year, and has shown wide fluctuations. Petroleum refining, which consumes large quantities of sulphuric acid and caustic has shown a very steady growth of about 7 per cent per year from 1916 to 1928. The production of explosives has increased slowly but steadily during the period 1904-1925, at the rate of about 2 per cent per year. The manufacture of paints and varnishes (1907-1927) has been increasing about 3.5 per cent per year.

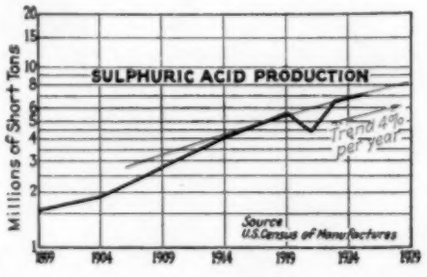
Sulphuric acid, which is the largest product of the chemical industry, either in point of value or volume, has shown a very steady trend of growth of about 4.5 per cent annually from 1899 to date. The production of soda ash, the next most important chemical, according to the statistics given in the Census of Manufactures, has increased about 6 per cent per year. One may object to the fact that the relatively slow rates of increase shown by these industries and commodities are not typical of the chemical industry as a whole, and point to such rapidly increasing products as chlorine, dyestuffs, and lacquer solvents. However, reference to another chart will show that although dyestuffs production increased tremendously during the war, since then the trend has sloped off to about 5 per cent per year and is likely to increase at an even slower rate in the future, more or less parallel to the textile industry, since the prospects of greatly increased foreign sales are not particularly bright.

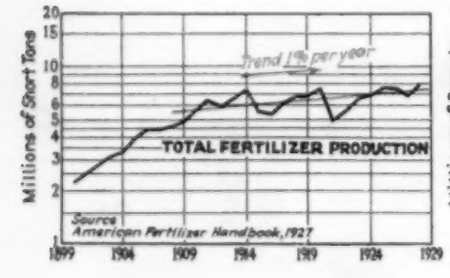
It is true that such products as chlorine and lacquer solvents have been increasing very rapidly, but they are of relatively small importance in comparison with the industry as a whole, and, furthermore, it is very noticeable that while lacquer solvents production continues to increase from year to year, it increases at a less and less rapid rate. The rayon industry is probably the fastest growing section of the chemical industry that is of any magnitude. The chart shows that its present trend is about 20 per cent per year, although some years ago it was practically 50 per cent.

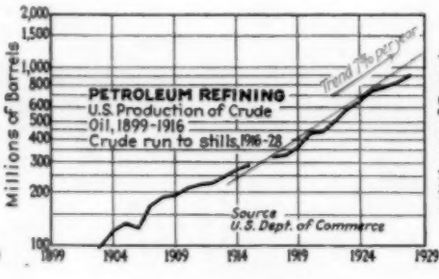
From the above discussion, therefore, it seems obvious that the trend of physical volume of production of the most important sections of the chemical industry is somewhere between 4 per cent and 6 per cent, and in any case is very much lower than the rate at which the profits of the industry's leading companies have been increasing. Some of the reasons for this divergence are discussed in the accompanying article on the "Financial Structure of American Chemical Industry."

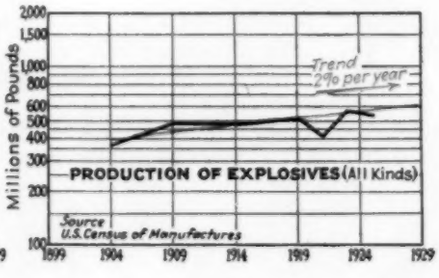


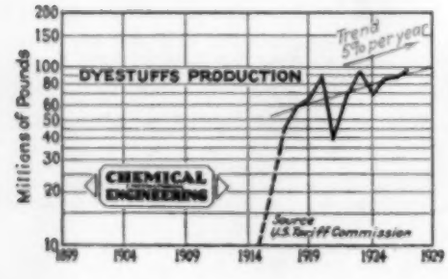

PHYSICAL VOLUME OF PRODUCTION (All Manufactures)
Index 1899=100
Source Review of Economic Statistics Vol. 9, 1927
Trend 4% per year

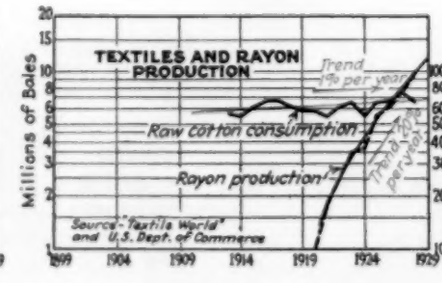


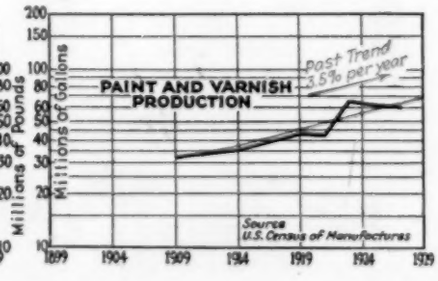



PETROLEUM REFINING
U.S. Production of Crude Oil, 1899-1916
Crude run to stills, 1916-28
Millions of Barrels
Trend 7% per year
Source U.S. Dept. of Commerce









By THEODORE M. SWITZ
Investment Research Corporation
Detroit, Michigan

Financial

Structure of American Chemical Industry

COMPLEXITY and extensive ramifications of the chemical industry are important obstacles in gaining a comprehensive view of its scope and economic character. Frequently it is described as the country's newest, or fourth largest, or most rapidly growing industry. Actually it is old and well established, and its major products are basic commodities comparable to pig iron, copper, rubber, or leather. In addition it has many new rapidly growing products that are less firmly established, and these usually receive a disproportionate amount of discussion. Important new developments constantly arise and changes take place, of course, but they may be compared with the growth and decay of the branches of a tree whose main trunk solidly withstands both storms and time.

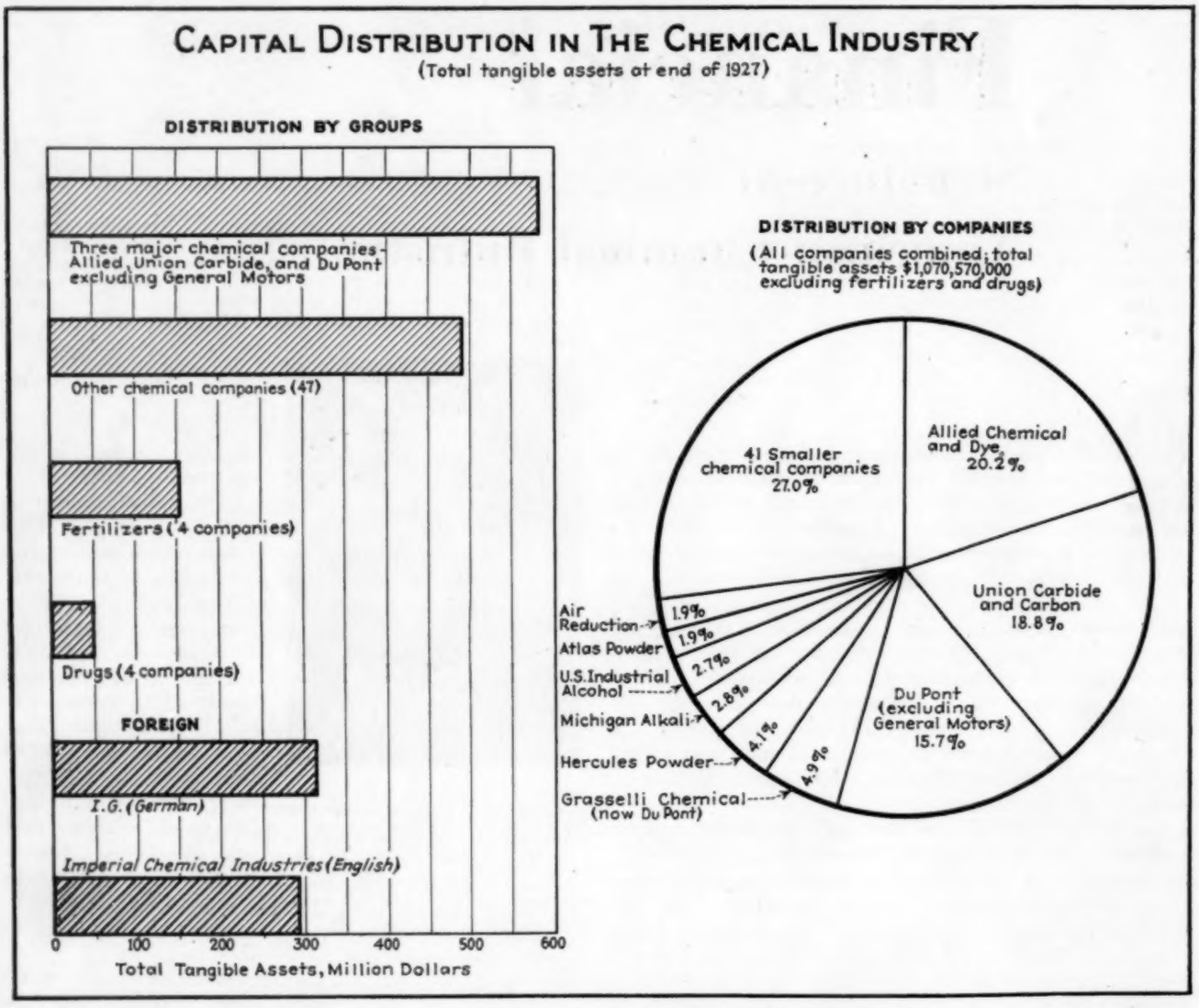
Largely because of the fact that chemistry plays an important part in all process industries, confusion often arises as to just what should be included in a discussion of the chemical industry proper, especially from the financial viewpoint. Theoretically, it is possible to decide that in the case of certain industries chemical or chemical engineering processes are involved to such an extent in making raw materials, in the manufacturing operations, or in the consumption of the finished product that they may legitimately be considered as chemical industries. Practically, the classification may be extended to include those industries in which the recognized chemical companies are engaged. Accordingly, in this article the term chemical industry will be used to include the following industries: heavy chemical, sulphur, alkali, coal-tar products, dyestuff and intermediate, fine chemical, explosives, rayon and cellophane, artificial leather, pyroxylin plastics, electrochemical, compressed gases, synthetic ammonia, and synthetic aliphatic chemical (including ethyl alcohol and lacquer solvents).

The size of the chemical industry is often overstated through a too generous inclusion of related commodities, and a distinction must be drawn between a classification of the industry according to technology and processes, and according to its corporate and financial setup. Thus *Chem. & Met.* elsewhere in this issue shows a total value of products made by the process industries of 11,700 million dollars on the basis of the 1927 Census of Manufactures. This total legitimately includes such industries as glass, coke, petroleum refining, and sugar, in which there is a common interest in the processes of chemical engineering. But the economic aim of these industries is to produce not chemicals but building materials, fuels, and foodstuffs respectively, while financially they are operated by companies outside the chemical field.

THE AUTHOR of this article draws upon an unusual background of training and experience. After graduating in chemical engineering from Lehigh in 1922 he was connected with the experimental chemical department of the Westinghouse Lamp Works in investigations of high-temperature refractories. A few years later, in order to complete his academic education, he entered the Royal College of Science of the University of London, from which he was graduated in 1926 with the degree of Ph.D. in organic chemistry. Then following two years connection with the research laboratory of the Combustion Utilities Corporation in the study of low-temperature tar problems, Dr. Switz joined the Investment Research Corporation to engage in economic and financial studies of chemical industry.—*The Editor.*

In discussing the financial structure of the chemical industry, therefore, some reclassification is necessary. The "value" of "chemicals and allied products" produced in 1925, according to the Census of Manufactures, was 6,400 million dollars, which is practically as much as the "value of products" of the entire iron and steel industry, thus making chemicals the fourth largest group of industries in the country, and exceeded only by foodstuffs, textiles, and iron and steel. But examination of the Census chemical figures shows that processed fuel industries such as the production of coke, the manufacture of gas and the refining of petroleum are included. When these items are omitted, the total value of the remaining products is 3,200 million dollars. However, even this total includes

many items that cannot be strictly classified as products of the chemical industry, such as "bluing", "glue and gelatin," "cottonseed oil," "paints and varnishes," and "soap." While such commodities are closely related to the chemical industry, they are excluded from the present discussion, because they are not usually made by concerns generally recognized as chemical companies. Likewise the bulk of fertilizers at present are made by companies specializing in that field. Deducting the values of these various products from the total given above leaves a net value of products of chemical industry proper amounting to about 813 million dollars, or approximately the size of tobacco manufactures and rubber products, but only slightly more than half as large as the electrical equipment industry.



The chart above on this page summarizes the facts concerning the size of the various sections of the American chemical industry, and of the leading European cartels. So many diverse companies can be compared only on the basis of their total tangible assets (at the end of 1927), and while the results are essentially rough, they do give an idea of size and relative importance. The domestic industry is most easily divided into the three leading companies, and all others. The three leaders, all of which are of approximately the same size, include Allied Chemical & Dye, duPont, and Union Carbide & Carbon. The total assets of these companies amount to $585,718,000, excluding duPont's investment in General Motors. These three combined exceed in size all other domestic chemical companies taken together. Furthermore, together they are almost twice as large as the famous German I. G. or the English Imperial Chemical Industries, both of which represent practically the entire chemical industry in their respective countries. The 47 smaller domestic chemical companies range in size from $300,000 to about $50,000,000 and total $484,852,000, making a total for all chemical companies large and small of $1,070,570,000. For comparison, the four leading fertilizer companies and the four chief drug companies are shown. Both groups are much smaller than the chemical companies.

One of the most important facts to be gained from this study is that the combined assets of the three leading companies in the industry amount to 55 per cent of the total, and that any one of them is broader in scope and more important than any ten of the remaining companies, although the latter are very substantial organizations indeed. These three leaders are tremendous horizontal and vertical combinations, and since the war have expanded until they cover the entire industry within the scope of their interests.

The Allied Chemical & Dye Corporation, which was formed as a merger of several important companies in 1920, is engaged in the most basic sections of the industry.

In 1928 its net tangible assets[1] amounted to $226,854,000 and its net income for dividends was $26,962,000. The company has numerous subsidiaries, each of which operates in its own special field. A list of these industries and of the corresponding subsidiaries is given below:

1. Acids and heavy chemicals
   (General Chemical Company)
2. Alkalis
   (The Solvay Process Company)
3. Building and operating byproduct coke ovens
   (Semet-Solvay Company)
4. Coal-tar products—e.g., benzol, phenol, tar, roofing
   (The Barrett Company)
5. Dyestuffs and intermediates
   (National Aniline & Chemical Company)
6. Synthetic ammonia and other nitrogen products
   (Atmospheric Nitrogen Corporation)

It is evident that these products, particularly heavy chemicals, alkalis, and coal-tar products, are the fundamental raw materials on which not only other industries but the chemical industry itself is reared. None of them, even including dyestuffs and synthetic ammonia, ever reaches the final consumer in original form; they are "producers' goods" and are consumed as raw materials by other manufacturing industries.

E. I. duPont de Nemours & Company is one of the oldest industrial organizations in the country, but its present size and scope far exceeds that of the pre-war company. Not only has it expanded until its manufacturing activities include the most important branches of the chemical industry but its brilliant investment of surplus funds in General Motors Corporation in 1919 has resulted in a greater present income from Motors' dividends than from all of its chemical operations. In 1928 the company's net tangible *chemical* assets (i.e., excluding General Motors investments) were $229,681,000 and its net income for dividends (excluding General Motors) was $23,883,000. The magnitude and importance of the General Motors holdings is shown by the consolidated 1928 figures for the whole duPont company: Net tangible assets were $369,418,000 and net income for dividends was $64,098,000. At present duPont is actually more a motor company than a chemical company!

The activities of the various duPont subsidiaries are enumerated below:

1. Powder and explosives
2. Rayon and cellophane
3. Dyestuffs and intermediates
4. Lacquers, paints and varnishes
5. Nitrocellulose-coated fabrics (Fabrikoid)
6. Synthetic plastics (Pyralin and Viscoloid, motion picture film)
7. Synthetic ammonia and nitrogen products
8. Heavy chemicals
   (Grasselli Chemical Company)

The duPont interests obviously center primarily about cellulose and nitrocellulose products. Most of these commodities are quite different from those made by Allied Chemical, and several of them go almost directly to the ultimate consumer. Rayon, ammunition, paints and varnishes, and pyroxylin plastics are good examples of the latter class. On the other hand, there is competition with Allied in the fields of dyestuffs and intermediates, synthetic ammonia, and also in heavy chemicals—particularly since the acquisition of the heavy chemical interests of the Grasselli company.

[1]Net tangible assets are total assets less intangibles (goodwill, patents, etc.), current liabilities and funded debt. This is the only figure on the basis of which all three companies can be compared over a period of years, although total tangible assets and total operating profits instead of net income for dividends would be preferable.

Union Carbide & Carbon Corporation had net tangible assets of $208,848,000 in 1928 and net income for dividends of $31,140,000. Its assets are slightly lower than those of the other major companies, but its earnings are higher. It is engaged in completely different fields from the other leading companies, as may be seen from the list of its activities given below:

1. Electrochemical and metallurgical products
   (Such as calcium carbide, ferro-manganese, ferro-silicon, silico-manganese, ferro-chrome, molybdenum, vanadium, titanium, tungsten, manganese.)
   (Union Carbide Company; Electro-Metallurgical Company)
2. Carbon products
   (Electrodes; batteries, and flashlights; radios; sunshine lamps)
   (National Carbon Company)
3. Compressed gases and welding equipment
   (Acetylene, oxygen, hydrogen, nitrogen, etc.)
   (Linde Air Products Company; Prest-O-Lite Company)
4. Chemicals (from natural gas)
   (Solvents, aliphatic chemicals, liquid hydrocarbons)
   (Carbide & Carbon Chemicals Corporation)

Each of these fields is separate and distinct and on the whole there is no overlapping with the fields in which the other two leading companies are engaged.

Most of the other chemical companies outside of these three confine themselves more or less to a single industry. Thus the Mathieson Alkali Works devotes its entire effort to the production of alkalis and chlorine; the Texas Gulf Sulphur and the Freeport Texas companies operate exclusively in the mining and sale of elemental sulphur; Atlas Powder and Hercules Powder make explosives primarily, although the former is interested also in the related field of pyroxylin lacquers and the latter in naval stores and nitrocellulose; the Celanese Corporation makes rayon; while companies like U. S. Industrial Alcohol and Commercial Solvents specialize in the production of fermentation alcohols and related products. Although these companies are smaller and limited in scope in comparison with the big three, most of them individually are considered to be large, well-managed industrial organizations.

During the past year or so the merger movement which has been in progress for some time, continued with full force. For example, horizontal integrations took place in the alcohol industry; the duPont company rounded out its vertical structure through the acquisition of the Grasselli interests; and the American Cyanamid Company, the Monsanto Chemical Works, and the Newport Company have each taken over several smaller companies. This raises the question of how far the present structure of the industry is likely to change. Of course the merger movement had become quite a fad in all industries by 1929, but there were important and fundamental reasons behind it, especially in the case of the chemical industry. This is evidenced by the fact that mergers in the industry are no new thing, having begun as early as 1895 with the formation of the General Chemical Company, and that concentration and centralization of the industry in Europe has now practically reached its upper limit.

Perhaps one of the most important forces behind the consolidation movement has been the fact that the large companies have steadily improved their earnings year after year, whereas the earnings of many of the smaller companies have been erratic and have shown little upward trend. While some lull is likely to take place from time to time, it seems entirely probable that the chemical

CHEMICAL & METALLURGICAL ENGINEERING

Balance Sheets of C

(In thousands of dollars)

	Total Tangible Assets	Total Current Assets	Total Current Liabilities	Net Working Capital	Net Property Investment	Investment in Affiliated Companies and Other Tangible Assets	Sales	Net Income After Taxes	Cash and Marketable Securities	Fiscal Year Ending
E. I. duPont de Nemours & Co...	371,838	108,329	22,285	86,044	88,974	196,820	.....	64,098	45,368	Dec. 31, 1928
Allied Chemical & Dye Corp.....	227,644	140,444	13,292	127,151	92,326	8,167	.....	26,962	97,807	Dec. 31, 1928
Union Carbide & Carbon Corp...	223,689	70,060	13,458	56,602	153,316	13,771	.....	30,577	17,503	Dec. 31, 1928
Eastman Kodak Co.....	104,722	70,202	19,435	50,768	53,399	555	.....	20,110	28,622	Dec. 31, 1928
National Lead Co.....	90,808	52,765	10,187	42,578	38,923	9,307	.....	5,872	10,174	Dec. 31, 1928
Procter & Gamble Co.....	88,830	65,961	7,414	58,547	27,775	330	210,615	15,579	7,001	June 30, 1928
The Cleveland-Cliffs Iron Co....	64,109	20,188	3,597	16,592	31,650	15,867	30,766	4,380	5,530	Dec. 31, 1928
Amer. I. G. Chemical Corp.....	60,868	58,484	547	57,937	.....	2,931	.....	94	31,723	May 31, 1929
Amer. Agricultural Chemical Co..	59,627	25,537	1,351	24,186	32,025	3,416	.....	2,028	5,833	June 30, 1928
Sherwin-Williams Co.....	41,631	26,195	3,952	22,243	17,585	1,803	6,962	4,902	4,666	Aug. 31, 1928
Amer. Cyanamid Co.....	39,274	14,205	4,168	10,037	26,593	2,644	.....	2,329	2,397	June 30, 1929
Hercules Powder Co.....	39,174	17,518	1,481	16,076	22,951	147	30,560	4,039	5,496	Dec. 31, 1928
Va.-Carolina Chem. Co.....	38,138	21,308	506	20,802	16,049	1,287	4,848	2,511	9,195	June 30, 1928
Michigan Alkali Co.....	32,277	13,778	1,679	12,099	20,178	.....	.....	.....	9,874	Dec. 31, 1928
U. S. Industrial Alcohol Corp....	31,412	13,728	2,391	11,336	19,285	791	.....	3,778	4,745	Dec. 31, 1928
International Agricultural Co....	29,400	10,492	691	9,801	18,738	861	3,821	1,447	2,172	June 30, 1928
Davison Chemical Co.....	25,167	5,809	1,270	4,539	17,900	2,728	2,309	2,930	2,440	June 30, 1928
Texas Gulf Sulphur Co.....	24,843	14,928	602	14,326	10,476	41	26,084	14,518	4,461	Dec. 31, 1928
Parke, Davis & Co.....	24,741	23,336	5,110	18,225	6,516	.....	.....	8,209	11,494	Dec. 31, 1928
Atlas Powder Co.....	22,998	15,626	1,588	14,038	7,000	1,960	21,249	5,840	7,789	Dec. 31, 1928
Air Reduction Corp.....	22,119	11,544	1,655	9,888	8,534	3,697	15,652	3,208	3,391	Dec. 31, 1928
Glidden Co.....	18,604	9,467	1,433	8,034	8,779	1,791	.....	2,261	633	Oct. 31, 1928
Tenn. Copper & Chem. Corp.....	18,347	5,668	807.	4,861	12,509	176	10,224	1,220	1,564	Dec. 31, 1928
Vanadium Corp. of America.....	17,661	6,523	432	6,091	11,207	363	.....	1,706	3,076	Dec. 31, 1928
Mathieson Alkali Works.....	15,542	3,592	1,012	2,580	12,962	1,369	3,319	2,041	1,374	Dec. 31, 1928
Penn. Salt Mfg. Co.....	13,502	3,624	594	3,029	9,427	1,046	.....	1,240	979	June 30, 1928
International Salt Co.....	13,391	1,601	144	1,457	11,604	330	.....	440	669	Dec. 31, 1928
Roessler & Hasslacher Chem. Co..	13,211	9,491	2,320	7,170	2,832	3,209	.....	.....	4,524	Dec. 31, 1928
Liquid Carbonic Corp.....	13,196	8,063	941	7,122	5,991	83	9,987	1,415	777	Sept. 30, 1928
Freeport Texas Co.....	12,562	8,644	2,637	6,007	5,908	647	13,174	3,276	3,470	Nov. 30, 1928
Dow Chemical Co.....	12,134	4,892	2,001	2,891	9,239	4	.....	2,430	716	Dec. 31, 1928
The Newport Co.....	11,652	5,238	821	4,417	6,896	339	7,495	685	4,299	Dec. 31, 1928

BELIEVING that the technologist as well as the non-technical executive will profit from a better knowledge of the fiscal affairs of the industry as a whole, Chem. & Met. *has compiled this tabulation of pertinent financial statistics for the principal companies in American and foreign chemical industries. The figures above are the latest available.*

CHEMICAL & METALLURGICAL ENGINEERING

Chemical Industry

(In thousands of dollars)

	Total Tangible Assets	Total Current Assets	Total Current Liabilities	Net Working Capital	Net Property Investment	Investment in Affiliated Companies and Other Tangible Assets	Sales	Net Income After Taxes	Cash and Marketable Securities	Fiscal Year Ending
Hooker Electrochemical Co.	11,394	1,346	618	728	10,017	649	.....	763	.....	Nov. 30, 1928
Tennessee Products Corp.	10,482	2,382	398	1,984	8,484	83	1,213	467	577	Dec. 31, 1928
Eli Lilly & Co.	10,346	6,896	1,639	5,257	4,970	119	.....	.....	2,717	Dec. 31, 1928
Monsanto Chemical Works.	9,488	3,648	691	2,957	6,319	212	.....	944	1,205	Dec. 31, 1928
Amer. Potash & Chemical Corp.	8,886	1,338	893	445	8,328	113	3,472	761	285	Dec. 31, 1927
Commercial Solvents Corp.	8,779	6,379	1,318	5,061	3,591	127	3,555	2,929	4,127	Dec. 31, 1928
Rossville Com. Alcohol Corp.	8,428	2,409	879	1,530	6,818	80	.....	.....	600	Nov. 30, 1928
Merck & Co.	7,953	6,527	410	6,117	1,233	603	.....	.....	1,209	Dec. 31, 1928
Amer. Commercial Alcohol Co.	7,931	3,349	984	2,365	5,265	301	1,560	711	516	Dec. 31 1928
E. R. Squibb & Sons	7,360	5,222	1,671	3,551	3,142	667	13,254	1,368	352	Dec. 31, 1928
Westvaco Chlorine Products Corp.	5,764	1,501	192	1,309	3,996	459	5,216	846	419	Dec. 31, 1928
Warner Chemical Co.	1,878	883	206	677	1,122	79	3,240	262	240	Dec. 31, 1928
Merrimac Chemical Co.	5,663	3,203	1,093	1,971	3,431	261	.....	.....	.....	Sept. 30, 1928
Great Western Electrochemical Co.	4,662	434	349	85	2,898	1,679	2,330	486	65	Dec. 31, 1928
Amer. Solvents & Chemical Corp.	4,576	2,458	290	2,168	2,333	75	1,649	671	745	Dec. 31, 1928
Binney & Smith Co.	3,071	4,264	2,161	2,103	576	400	.....	.....	2,463	Dec. 31, 1928
Harshaw Chem. Co.	3,045	2,654	634	2,020	872	153	9,401	648	554	Dec. 31, 1928
Niagara Alkali Corp.	2,877	851	115	736	1,472	669	3,300	.....	472	Dec. 31, 1928
Heyden Chemical Co.	2,341	815	178	637	1,656	48	.....	325	105	Dec. 31, 1928
Victor Chem. Works.	2,249	1,170	280	890	1,359	.....	.....	404	1,084	Dec. 31, 1927
Innes Speiden Co.	1,504	651	192	457	205	842	3,697	.....	128	Dec. 31, 1929
Zinsser & Co., Inc.	1,815	545	324	222	1,872	721	1,590	36	78	Dec. 31, 1928
J. T. Baker Chemical Co.	1,261	1,119	438	681	557	23	2,224	198	58	Dec. 31, 1928
International Oxygen Co.	1,104	327	161	166	863	28	.....	115	37	Dec. 31, 1928
Barium Reduction Corp.	778	356	66	290	396	.....	.....	.....	194	Dec. 31, 1928
Franco-American Chem. Works.	463	330	165	165	296	2	.....	.....	21	Mar. 31, 1929
Borax Consolidated	30,680	19,942	9,631	10,311	20,098	271	.....	829	6,190	Dec. 31, 1928
I. G. Farbenindustrie	342,300	260,000	98,300	161,700	107,600	73,000	.....	28,200	59,783	Dec. 31, 1928
Imperial Chemical Industries	384,875	97,507	36,469	61,038	.....	332,015	.....	27,727	84,469	Dec. 31, 1928
Etablissements Kuhlmann	14,896	8,247	4,069	4,178	6,701	4,017	.....	1,354	1,456	Dec. 31, 1927
Norsk Hydro	59,655	23,200	6,645	16,555	31,700	11,400	11,700	384	16,800	June 30, 1928

INCLUDED in this compilation are all of the principal chemical companies for which current financial data are generally available from published or unpublished sources. The companies have been ranked on the basis of total tangible assets, i.e., the sum of the net current assets, the net property account and other investments.

industry will continue to organize itself into large units. There is but little difference, for example, between the chemical industry and the electrical equipment industry, in which there are only two outstanding companies—General Electric and Westinghouse. Small chemical companies that make standard products are unlikely to be able to compete with the big producers in the future. On the other hand, in any industry there always is room for the small producer who makes specialties or exceptionally high-grade products or otherwise renders a distinctive service.

The earnings record of the chemical industry since the depression of 1921 has been remarkable. During the period from 1923 to 1927 the profits of 14 chemical and drug companies increased at the average rate of 12.3 per cent per year, according to figures collected by the Federal Reserve Bank of New York. This is well above the average increase of 9 per cent per year shown by 381 industrial corporations during the same period. The following table shows the relative position of the chemical industry in comparison with other leading industries:

Average Annual Rate of Change of Profits

(1923–1927)

	Per Cent
22 motor companies	+22.5
6 amusement companies	+18.2
129 public utility companies	+14.7
14 *chemical and drug companies*	+12.3
381 industrial corporations	+ 9.0
26 steel companies	+ 0.4
12 railroad equipment companies	— 6.1
24 clothing and textile companies	—10.5

Source: "Recent Economic Changes in the United States", McGraw-Hill Book Company, 1929, page 641.

This steady increase in profits needs some further consideration. Can it be explained as the result of growth in consuming demand for chemicals as a whole, as the result of expanding plants, as the result of increased prices, or is it the result of greater efficiency of production and distribution with consequent decline in costs? Some answer to these questions can be obtained by considering the operating records of the three major chemical companies, duPont, Allied and Union Carbide, as shown below (duPont's assets and earnings have been adjusted to a comparable chemical basis by removing General Motors assets and dividends respectively):

Growth and Increasing Profitableness, Three Leading Companies Combined

	A Net Tangible Assets*	*B* Net Income for Dividends	Profitableness Ratio $\frac{B}{A}$ Per Cent
	(Thousands of dollars)		
1922	428,517	33,231	7.7
1923	469,974	45,814	9.7
1924	486,704	46,307	9.5
1925	506,630	55,826	11.0
1926	546,220	65,063	11.9
1927	568,621	67,427	11.9
1928	665,383	81,985	12.3

*See footnote on page 11.

Net income, according to these figures, has shown an average rate of increase during the period of 14.2 per cent per year (ranging from 8.9 per cent in the case of Allied to 19.4 per cent for duPont). In other words, the earnings of the leading companies have been growing more rapidly than the average of the group of 14 companies mentioned above. Net tangible assets likewise have been increasing as the companies' activities have expanded, either through the plowing back of earnings or the floating of new securities, but not as rapidly as earnings have expanded. This is clearly shown in the third column of the foregoing table. In 1922, the three companies earned an average of 7.7 per cent on their net tangible assets. This rate of profits increased year after year until in 1928 the companies earned 12.3 per cent on their assets. Since chemical prices declined in the period 1922 to 1924 and have remained about constant from that time on, this cannot serve as an explanation of the increasing profitableness of the companies' operations. The chief explanation is the thorough going rationalization or reorganization that has been going on throughout all industries during this period, with consequent reduction in costs. This includes operating plants nearer to capacity, greater mechanization of equipment and material handling, increasing application of research studies and scientific control to factory operations as well as to more efficient merchandising. It is noteworthy, however, that during the same years the General Electric Company, which is similar in management and structure to these companies, although much larger (net tangible assets $396,000,000 at the end of 1928), has increased its earnings at a rapid rate, but comparison shows that the net tangible assets have increased almost as rapidly, so that the profitableness of the company's activities shows no upward trend. (This is partially to be explained by the hiding of earnings, especially through too rapidly charging off depreciation of plant.)

IN THE LONG RUN, any increase in profits depends upon corresponding increases in the demand for the products of the chemical industry, for there always is an upper limit above which prices cannot be raised, and a lower limit below which costs cannot be reduced. In order, therefore, to find out whether the earnings of the industry can continue to grow at so rapid a rate, it is necessary to investigate the past and prospective rates of growth of the various chemical-consuming industries. The results of such a study are given on page 8 of this issue.

From that discussion, it seems obvious that the trend of physical volume of production of the most important sections of the chemical industry is somewhere between 4 per cent and 6 per cent, and in any case is very much lower than the rate at which the profits of the industry's leading companies have been increasing. In general under stable conditions, the larger the company the more nearly must its profits increase at the rate of physical demand for the industry's products, no matter how efficient the company's management. On the other hand, the smaller company, representing only a fraction of the industry's total production, has at least a chance of increasing faster than the industry as a whole, since by aggressive management and sales ability it may be able to take markets away from other companies. Past experience, however, shows this to be the exception rather than the rule.

In any case for many years to come the earnings of the large chemical companies are likely to increase much faster than the physical demand for the products of the industry. This is partly because the efficiency of production, administration, and marketing will be further increased, partly because smaller companies will be taken over and put on a more profitable basis and finally because the large companies as a result of their great financial resources and research facilities will introduce most of the important technical innovations and new products.

Commercial

Structure of American Chemical Industry

CHEMICAL industry in recent years has been benefited to an increasing extent by the volume of statistical information that has come to it through the government bureaus, its trade associations, and the business press. Production figures now available in considerable detail have helped the industry to establish its position in relation to the whole business structure and in turn have helped the individual manufacturer to determine his own status in relation to his particular field of competition. Distribution figures, which might be much more valuable from the purely commercial viewpoint, have been lacking except for a few scattered studies. This year, however, for the first time, the government will take a Census of Distribution, and at least a start will be made toward the collection of data in this immensely important field.

But always one is inclined to ask, what lies behind these figures? What do the totals mean in terms of individual companies and products and markets? What does this company make? Where does it sell its product? Who are its competitors? Where are its plants located? How long has it been established? What is its standing in the industry? In effect, who's who in chemical industry?

These are the sort of questions that usually go unanswered, or at best are the subject of gossip and conjecture. For too many companies, the necessary facts and figures although harmless in themselves are carefully kept in the category of the unmentionables. If this spell of secrecy could be broken, both producer and consumer would be benefited. Chemical industry would take its place with the automobile, the iron and steel and other industries in which commercial information is freely exchanged and openly available to all.

Chem. & Met. in previous annual review numbers has laid stress on the interdependence and inter-relation of the chemical engineering industries. It has shown, for example, in quantitative statistical studies how 75 per cent of the output of the heavy chemical industry is consumed within the group itself. This year, however, as a modest beginning toward the accumulation of more intimate and detailed information about the companies that comprise chemical industry, the editors have made an interesting qualitative study of the products and markets of more than a hundred firms. The results of this compilation are presented in the tabulations on the two following pages. Where available from published sources, additional information is included on the dates of establishment, the location of the principal plants and the number of establishments operated. In the main, the companies listed correspond to those in the preceding compilation—thus rounding out in a measure the complete picture of the financial and commercial structure of American chemical industry.

IN ADDITION to its obvious value as a reference source for information on individual companies, the compilation reveals a number of interesting characteristics of chemical industry as a whole. There is, for example, a striking diversity of both products and markets. To the producer this often means the assurance against serious interruption of production as business conditions fluctuate in various consuming industries. To the consumer it brings the advantages of a steady supply of raw material at prices based on a larger scale of production than would be dictated by the consumer's own requirements. It is also apparent from the compilation that no individual company controls a monopoly in any single one of the groups of products. This is not necessarily true in the case of highly specialized commodities, but as long as there is competition within the group, other sources of supply usually can be developed.

Of the consuming industries it is of interest to note that the chemical industry itself represents a market for the products of 98 of the 112 companies. Textiles, including rayon, represent the second largest market, although pharmaceuticals, leather, rubber, and pulp and paper are all important outlets for chemicals.

Any compilation, such as the present one, is, of course, subject to criticism on the basis of classification of products, the definition of the markets, and the selection made not only of the companies but of the principal products, markets, and plants of each. In the interest of accuracy and increased usefulness, the editors would welcome criticism as well as the necessary corrections that should be made in any subsequent compilation. The study will have served its purpose, however, if it conveys to the reader a better picture of the commercial and market structures of chemical industry than can be obtained from the bare statistics of production and distribution.

Production and Distribution Data fo

Companies and principal subsidiaries	Principal Products: Acids	Nitrogen and compa.	Sodium compounds	Potassium compounds	Alum and Al. compa.	Bleaching compounds	Coal-tar products	Plastics and pyroxylin compa.	Compressed gases	Pigments, paints, & varnish	Pharmaceuticals	Solvents	Chemicals, miscellaneous	Principal Markets: Textiles	Chemicals	Paint, varnish, and lacquer	Food	Fertilizer	Insecticides, etc.	Pharmaceuticals	Cosmetics	Photography	Mining and metallurgy	Glass and ceramics	Leather	Rubber	Explosives	Pulp and paper	Petroleum	Building	Date of Establishment	Principal plant locations and number of establishments
Air Reduction Corp.		X								X					X			X				X		X				X	1916	Elizabeth, N. J. (62)
Allied Chem. & Dye Corp.																														1920	
Atmospheric Nitrogen Corp.		X													X			X												1919	Syracuse, N.Y.; Hopewell, Va. (2)
Barrett & Co.							X				X				X	X		X		X		X							X	1854	(32)
General Chem. Co.		X	X		X								X		X	X		X	X			X	X		X	X				1899	(16)
National Aniline & Chem. Co.							X				X		X		X	X		X				X	X							1917	Marcus Hook, Pa.; Buffalo, N.Y. (2)
Semet-Solvay Co.							X									X		X					X							1916	Syracuse, N Y.
Solvay Process Co.			X			X		X							X	X							X	X						1881	Syracuse, N. Y. (3)
Amer. Agricultural Chem. Co.	X	X														X		X												1893	(39)
Amer. Aniline Products, Inc.							X								X																Lock Haven, Pa.; Nyack, N.Y. (2)
Amer. Commercial Alcohol Co.													X	X	X	X			X	X				X						1928	Pekin, Ill.; Philadelphia, Pa. (4)
Amer. Cyanamid Co.		X	X	X				X					X	X	X	X		X	X				X						X	1907	Niagara Falls, N.Y.; Warners, N.J.
Calco Chem. Co.		X					X				X				X	X			X					X		X				1915	Bound Brook, N. J. (3)
Kalbfleisch Corp.		X	X	X									X	X	X	X			X					X	X					1829	Elizabeth, N. J.; Erie, Pa. (6)
The Selden Co.							X								X	X			X												Pittsburgh, Bridgeville, Pa. (2)
Amer. I. G. Chem. Corp.							X						X		X	X			X					X						1929	
Amer. Potash & Chem. Co.		X	X												X	X		X						X			X			1913	Trona, Calif. (1)
Amer. Solvents & Chem. Co.									X				X	X	X	X			X	X				X						1926	Agnew, Cal.; New Orleans, La. (6)
Atlas Powder Co.	X					X							X			X								X		X				1912	(13)
J. T. Baker Chem. Co.	X		X	X									X		X															1904	Phillipsburgh, N. J. (2)
Barium Reduction Corp.													X		X	X								X					X	1923	Charleston, W. Va. (1)
Binney & Smith Co.											X		X		X	X		X		X				X		X				1902	Easton, Pa. (1)
Carus Chemical Co.			X											X	X	X		X						X							La Salle, Ill.
Chemical & Dye Corp.				X											X	X		X												1927	Spring'ld, N. J.; Ashland, Mass. (3)
Cleveland-Cliffs Iron Co.	X	X										X	X		X	X					X	X								1891	
Commercial Solvents Corp.												X			X	X		X		X				X						1919	Peoria, Ill.; Terre Haute, Ind.
Chas. Cooper & Co.	X				X							X	X		X	X		X		X										1857	Newark, N. J. (1)
Davison Chemical Co.	X											X			X	X													X	1832	Baltimore, Md. (3)
Silica Gel Corp.												X				X													X	1921	Baltimore, Md. (2)
Diamond Alkali Co.		X		X		X									X	X			X				X	X							Painesville, O. (1)
Dow Chemical Co.	X	X		X	X	X				X	X	X	X		X	X			X	X			X	X					X	1897	Midland, Mt. Pleasant, Mich. (2)
E. I. DuPont de Nemours & Co.	X			X	X		X			X		X	X		X	X			X				X	X					X	1902	Deepwater, Parlin, N. J. (67)
Grasselli Chem. Co., Inc.	X		X	X				X				X	X		X	X			X				X	X					X	1839	Cleveland, O.; Grasselli, N. J. (19)
Krebs Pigment & Chem. Co.								X							X								X							1901	Newport, Del. (1)
Eastern Alcohol Corp.													X		X	X		X		X				X						1925	Deepwater Point, N. J. (1)
Du Pont Ammonia Corp.		X	X						X			X			X	X														1924	Belle, West Virginia (1)
Pacific Nitrogen Corp.		X							X						X			X													Seattle, Washington (1)
National Ammonia Co., Inc.		X							X						X	X															St. Louis, Mo. (4)
Eastman Kodak Co.					X							X	X		X				X					X						1892	Rochester, N. Y. (2)
Tennessee Eastman Co.	X	X										X	X		X	X													X	1920	Kingsport, Tenn. (1)
Eli Lilly Co.					X			X				X	X					X													Indianapolis, Ind. (2)
Freeport Sulphur Co.													X		X	X		X	X	X									X	1911	Freeport, Tex. (1)
Franco-American Chem. Works.					X							X	X		X	X			X					X						1900	Philadelphia, Pa. (2)
General Dyestuff Co.							X								X																
Glidden Co.										X			X		X	X								X		X				1870	(25)
Gt. Western Electrochem. Co.	X	X	X		X								X		X	X			X				X						X	1926	Pittsburg, Calif. (3)
Harshaw Chem. Co.		X	X										X		X	X							X	X							Cleveland, Elyria, O.; Phila., Pa. (3)
Hercules Powder Co.	X				X							X	X		X	X								X		X				1912	Kenvil, N. J.; Brunswick, Ga. (18)
Heyden Chemical Co.				X			X				X		X		X	X			X											1900	Garfield, Perth Amboy, N. J. (2)
Hooker Electrochem. Co.	X		X		X		X	X	X				X		X	X			X					X		X				1903	Tacoma, Wash.; Niagara Falls, (2)
Internat. Agricultural Corp.	X		X						X				X		X	X			X											1909	Cincinnati, O.; Mont'ery Ala. (27)
Inter. Com. Tar & Chem. Co.	X			X		X			X				X		X	X								X					X	1908	Chicago, Ill. (5)
International Oxygen Co.					X								X		X	X							X							1910	Newark, N. J. (4)
International Salt Co.		X													X	X														1901	Ludlowville, Ky.; Avery, La. (8)
Innes Speiden Co.	X	X		X									X		X	X								X		X				1816	Niagara Falls, Oswego, N. Y. (4)
A. Klipstein Co.				X									X		X	X								X		X				1872	

ta for American Chemical Industries

Companies and principal subsidiaries	Principal Products: Acids	Nitrogen and comps.	Sodium compounds	Potassium compounds	Alum and Al. comps.	Bleaching compounds	Coal-tar products	Plastics and pyroxylin comps.	Compressed gases	Pigments, paints, & varnish	Pharmaceuticals	Solvents	Chemicals, miscellaneous	Principal Markets: Textiles	Chemicals	Paint, varnish, and lacquer	Food	Fertilizer	Insecticides, etc.	Pharmaceuticals	Cosmetics	Photography	Mining and metallurgy	Glass and ceramics	Leather	Rubber	Explosives	Pulp and paper	Petroleum	Building	Date of Establishment	Principal plant locations and number of establishments
Liquid Carbonic Corp.					X			X							X		X			X					X		X			1888	Chicago, Ill. (28)
Mallinckrodt Chemical Works.	X		X	X							X		X	X		X	X			X		X		X		X					St. Louis, Mo. (4)
The Matheson Co.								X							X		X														North Bergen, N. J. (1)
Mathieson Alkali Works, Inc.			X	X				X					X	X	X								X	X					X	1892	Niagara Falls, N. Y.; Saltville, Va.
Merck & Co.	X		X	X							X		X	X	X					X	X									1891	Rahway, N.J.; Philadelphia, Pa. (2)
Metal & Thermit Co.								X					X		X									X							Pittsburgh, Pa.
Michigan Alkali Co.			X											X	X					X				X					X		Wyandotte, Mich. (1)
Monsanto Chemical Works.	X		X	X	X	X					X		X	X	X	X	X			X	X		X	X					X	1901	St. Louis, Mo.; Monsanto, Ill. (3)
Merrimac Chemical Co.	X		X	X	X						X		X	X	X	X	X			X	X		X	X					X	1853	Everett, Woburn, Mass. (4)
Mutual Chemical Co.	X		X	X										X	X	X				X			X						X	1845	Jersey City, N. J.; Balti, Md. (2)
National Lead Co.											X			X		X	X			X			X							1891	(32)
New Jersey Zinc Co.	X										X		X	X	X	X				X	X			X							1848	Palmerton, N. J.
The Newport Co.	X					X					X	X	X	X	X	X				X	X			X							1919	Carrolville, Wis.; Passaic, N. J. (5)
Rhodia Chemical Co.						X					X		X		X					X	X										New Brunswick, N. J. (1)
Niagara Alkali Co.	X		X	X	X	X								X	X								X	X					X	X	1910	Niagara Falls, N. Y. (1)
Pac. Coast Borax Co.			X										X	X	X					X	X		X	X								
Parke, Davis & Co.											X		X		X					X	X										1866	Detroit, Mich. (1)
Pennsylvania Salt Co.	X		X	X	X			X						X	X	X	X			X			X	X		X					1850	Phila., Pa.; Tacoma, Wash. (5)
Chas. Pfizer & Co., Inc.	X			X									X		X		X			X										1849	Brooklyn, N. Y. (1)
Philadelphia Quartz Co.			X								X			X	X								X					X	X		Rahway, N. J.; Chester, Pa. (7)
Procter & Gamble Co.													X	X	X		X			X	X			X							1837	Port Ivory, N. J.; Ivorydale, O. (4)
Roessler & Hasslacher Chem. Co	X		X	X	X			X			X		X	X	X	X	X			X	X		X	X		X					1889	Perth Amboy,; Niagara Falls, (3)
Niacet Co.	X												X	X	X									X								Niagara Falls, N. Y. (1)
Rohm & Haas Co., Inc.			X	X		X							X	X	X	X	X			X												Bristol, Bridesburgh, Pa. (2)
Rossville Comm. Alc. Co.	X	X											X	X	X	X				X	X			X							1929	Rossville, Ind.; New Orleans, La. (6)
Sharples Solvent Corp.	X												X		X	X				X												Charleston, W. Va. (1)
Sherwin-Williams					X	X		X					X	X	X		X							X							1866	Cleveland, Ohio, Chicago, Ill. (12)
E. R. Squibb & Sons								X					X		X					X											1858	B'klyn, N.Y.; New Bruns'k, N.J. (6)
Standard Wholesale Phos. & Acid Works	X												X		X		X														Baltimore, Md.; Willimaston, N.C.
Stauffer Chemical Co.	X		X										X	X	X	X	X											X			1885	Baton Rouge,; Niagara Falls, (15)
Sterling Products Co.	X		X	X									X		X		X			X												Easton, Pa.
Swann Corporation																															1928	Anniston, Ala. (4)
Federal Phosphorous Co.	X		X				X						X	X	X		X			X												Anniston, Ala.
Southern Manganese Comm.													X		X								X									Anniston, Ala.
Federal Carbide Co.													X		X								X									Anniston, Ala.
Provident Chem. Works			X										X	X	X		X			X												St. Louis, No.
Iliff-Bruff Chem. Co.													X		X		X			X								X				Hoopeston, Ill.
Tenn. Copper & Chem. Corp.	X												X	X	X			X									X		X		1899	Copperhill, Tenn. (1)
Tenn. Products Co.	X		X										X	X	X					X	X			X								(10)
Texas Gulf Sulphur Co.				X									X	X	X								X						X		1909	Gulf, Texas. (2)
Union Carbide & Carbon Corp.													X	X									X	X							1917	
Carbide & Car. Chem. Corp.											X		X	X	X								X						X		1920	South Charleston, W. Va. (1)
Linde Air Products Co.											X		X	X	X								X								1907	(58)
Prest-O-Lite Co., Inc.											X			X									X								1913	Indianapolis, Ind. (40)
Union Carbide Co.													X	X									X								1898	Niagara Falls, N. Y. (2)
U. S. Industrial Alcohol Co.													X	X	X					X			X								1906	Baltimore, Md.; Peoria, Ill. (2)
Vanadium Corp. of America.											X		X		X								X								1906	Bridgeville, Pa.; Niagara Falls,
Victor Chemical Works.	X		X										X	X	X																1902	Chicago, Ill.; Nashville, Tenn. (2)
Virginia-Carolina Chemical Co.	X												X		X	X															1895	
Warner-Klipstein & Co.						X							X	X										X	X							Charleston, W. Va.
Westvaco Chlorine Prod. Corp.		X		X		X					X		X	X	X		X			X				X	X						1902	South Charleston, W. Va. (2)
Warner Chemical Co.	X	X		X		X					X		X	X	X		X			X				X	X						1886	Carteret, N. J. (1)
Wilckes-Martin-Wilckes.		X					X						X		X	X	X							X								Camden, N. J. (1)
Wood Products Co.		X											X	X	X								X	X								Buffalo, N. Y.
Zinsser & Co.	X				X			X					X	X	X									X						X	1897	Hastings-on-Hudson, N. Y. (1)

How Are We

Technical

A Staff

AT THIS SEASON the civilized world takes stock of its position and records the gains with optimism and the red figures with chagrin. Technology is fortunate in that its red figures represent only ends not yet accomplished, while even its negative results are worth while, for they show the roads to be avoided and suggest the proper course. In such a field, where losses generally are left-handed gains, even a period of doubtful accomplishment is not adequate excuse for grumbling. The period of two or three years just past is certainly not such a time, for it has been highly productive.

Outstanding as an indication of our changing technical structure is the tendency toward high pressures, frequently coupled with elevated temperatures far above anything previously attempted. This has required new control methods, new construction materials, new fabricating methods. It has given us new products and processes.

Nitrogen fixation might be called both the parent and off-spring of high pressure technology. Pressures in this field are on the increase, with 15,000 lb. not uncommon. The arc fixation process has been driven from its last stronghold in Norway, while direct ammonia processes are being installed throughout the world. High pressure is necessary, not only for inducing the combination of hydrogen and nitrogen, but in the production of these gases if hydrogen is obtained from coke-oven gas, as in several European plants, or nitrogen from air other than by the combustion of hydrogen. High pressure is an integral part of the corollary process of methanol synthesis being used in several plants as an outlet for the byproduct, carbon monoxide.

OTHER syntheses are also employing high pressures. The year saw the start of a petroleum hydrogenation industry in the United States. Pressure vessels for the first unit are reported to be the largest forgings ever made. With its prospect of turning anything from crude oil to refinery "slops," or even coal, to more than 100 per cent of first quality gasoline, hydrogenation constitutes an active threat against the cracking processes.

High pressures have definitely arrived in the boiler plant. Boilers operating as high as 1,800 lb. are no longer a curiosity in the United States, while European plants have operated at the critical pressure. Economy is the motivating factor although occasionally the demand for super-pressures in process steam exists, witness the explosion process for the preparation of fiber board from wood waste.

High pressures have entered another branch of the fuel field, namely, gas distribution. Not only is gas stored at high pressure but it is piped and pumped hundreds of miles. Development of this phase of gas handling has resulted in the opening of vast sections of the country to natural gas.

HIGH temperatures have come to stay. Such temperatures as a thousand degrees in a cracking unit, and more in a sulphuric acid converter or the catalyst chamber of an ammonia set, do not begin to tell the story. New construction materials have been an absolute necessity. A completely new design technique, involving the creep of metals at high temperatures and pressures has had to be developed to deal with such strenuous conditions.

Even the methods for the production of high temperatures have had to be revised in certain cases. An outstanding example is the use of diphenyl vapor in lubricating oil production. This high-boiling, non-oxidizing compound has permitted higher temperatures than were possible with steam, at much lower pressures in the heating apparatus.

New syntheses, new difficult conditions, harder competition in the older lines have all co-operated in forcing development of new methods of control. Manufacture of beet sugar is being automatically controlled in some of its most delicate details; water-gas production has become

Building the Structure Review

almost completely automatic. New instruments control the proportions of ammonia and air in ammonia oxidation, of hydrogen and nitrogen in ammonia synthesis. Electrical gas analysis has been brought to a high level of perfection and flow controllers to complete reliability. Other instruments of many types may now be trusted where reliance on the human element would be a risky and often costly proceeding.

Construction materials are improving rapidly. Hydrochloric acid, once the blight of the chemical engineer's life, is now just another acid, with better ceramic materials available, better methods of installing them, more reliable enamelled steel, rubber linings both hard and soft that offer years of life. As a final development, a nickel - molybdenum - iron alloy is accredited with having drawn the teeth of this acid almost completely.

A nickel-silicon steel, first offered during 1929, possesses excellent resistance against weak sulphuric acid, hot or cold. Externally enamelled boiler tubes have become available for combating the ravages of high-sulphur coals. Alloy cast irons and low-alloy steels have been used successfully in many cases.

PERHAPS the greatest development has been in chromium-iron and chromium - nickel - iron alloys. During 1929 the Krupp Nirosta alloys were first produced on a large scale in the United States. Other analyses in considerable number are being made under other patents. Never before has the metallurgist been so completely in the public eye.

In fabrication, welding has taken an increasingly prominent part. One plant has used it for nearly everything weldable. Others are following suit. Thousands of miles of gas and oil line pipe have been made by this means. Building codes are rapidly being revised to permit structural welding, and boiler codes will shortly be revamped in the same direction. Meanwhile, two new non-destructive tests for welds have done much to further confidence in this form of fabrication.

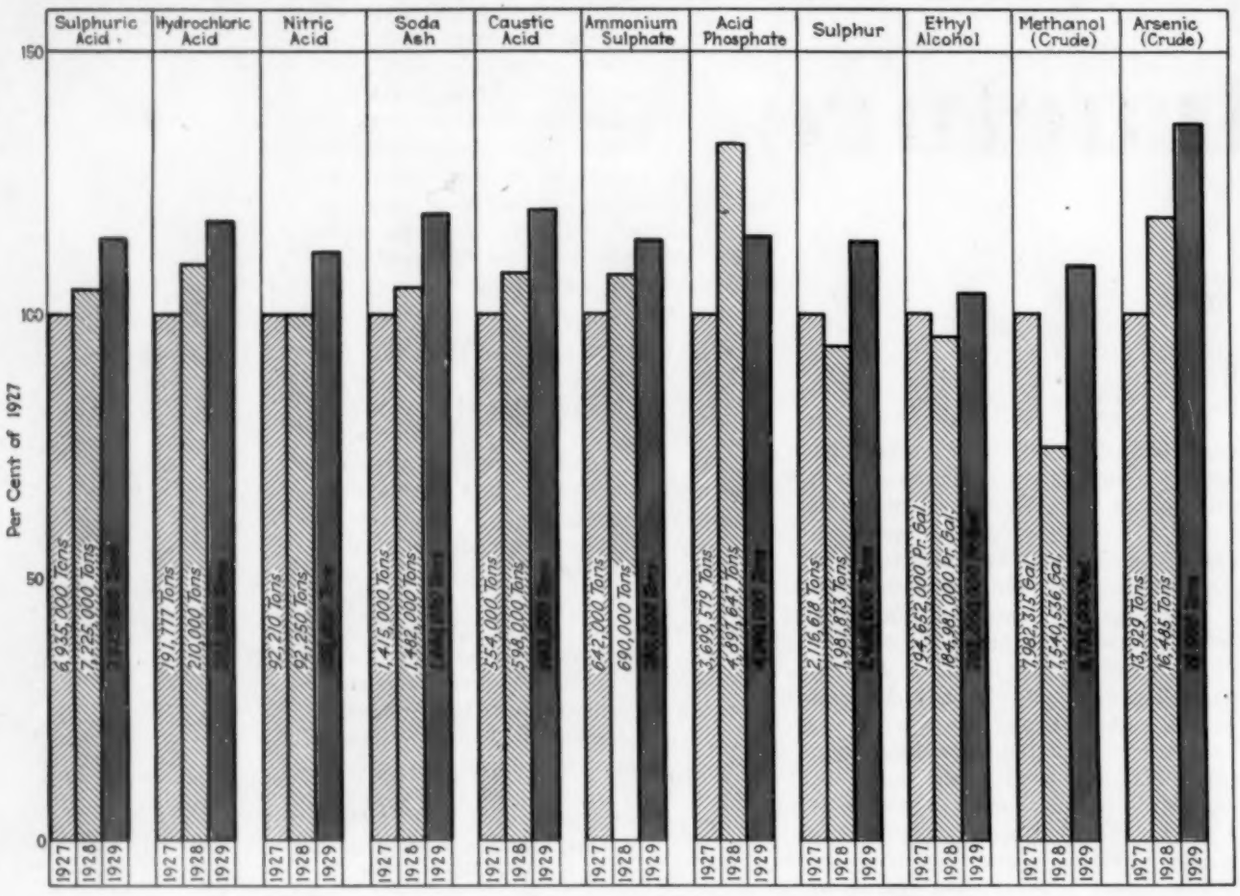
RESEARCHERS were not idle, nor were their efforts unrewarded. Chemical engineers followed close on their heels, putting the results of their work into the plant. Petroleum hydrogenation, previously referred to, is a development of the first magnitude. A new process for making cellulose acetate is another. Vanadium catalysts for sulphuric acid production are most important among improvements in heavy chemical production, giving as they do higher conversion and immunity from poisoning.

Synthetic sodium nitrate has been made on a considerable scale in Virginia. Diphenyl, mentioned above, has left the class of a $40 per pound curiosity, and has been synthesized to sell in carload lots, offering possibilities not only as a heating agent but as a starting point for other syntheses. One manufacturer, during the year, produced synthetic ethyl alcohol in semi-commercial quantities from a petroleum derivative, a potent answer to the threat of a prohibitive tariff on blackstrap molasses.

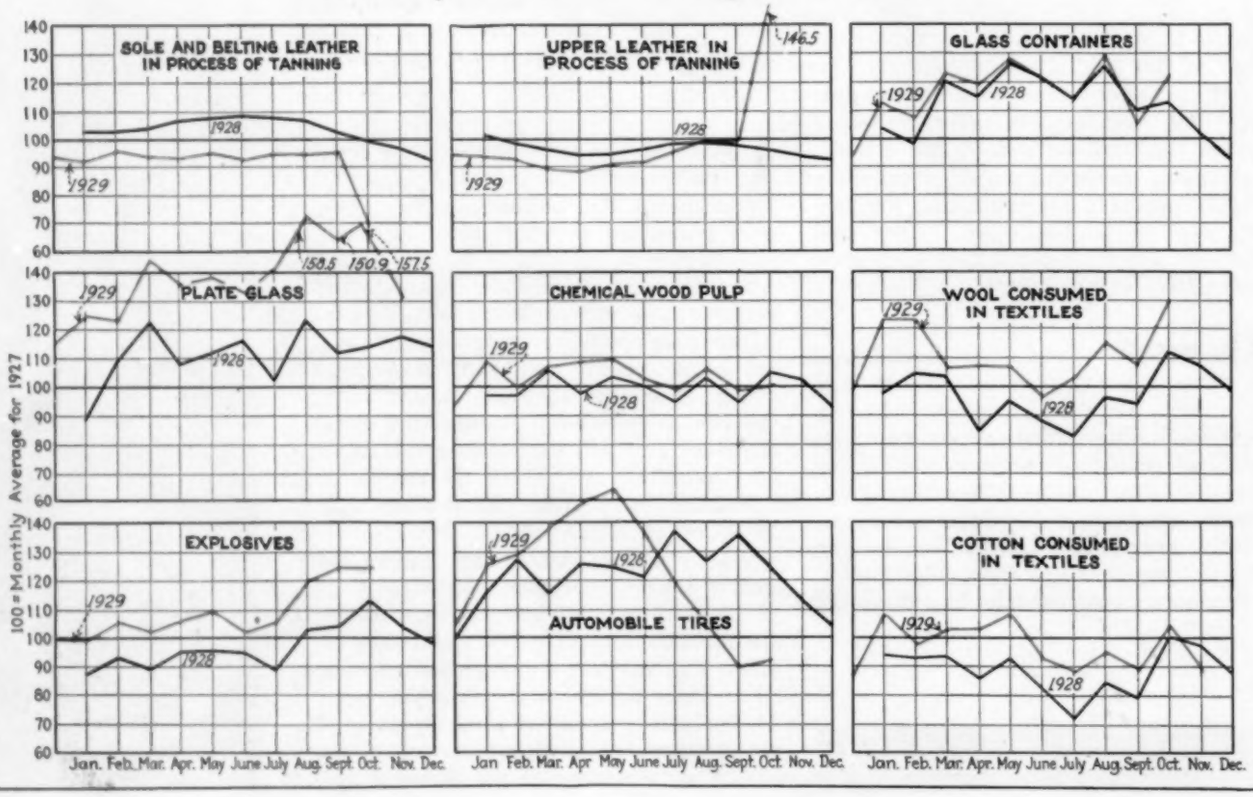
PAPER has been made from cornstalks, while the cobs have supplied furfural by the tankcar load. Technical aluminum chloride, after 15 years of experiment, is now a 5c per pound commodity. Searles Lake is supplying potash salts in considerable quantity. Absorption processes, such as the Suida, are being used in producing acetic acid direct from pyroligneous liquor while the acid also is being synthesized from acetylene and will shortly be made from ethyl alcohol. In Europe the anhydride is made directly from glacial acetic acid by means of a catalyst.

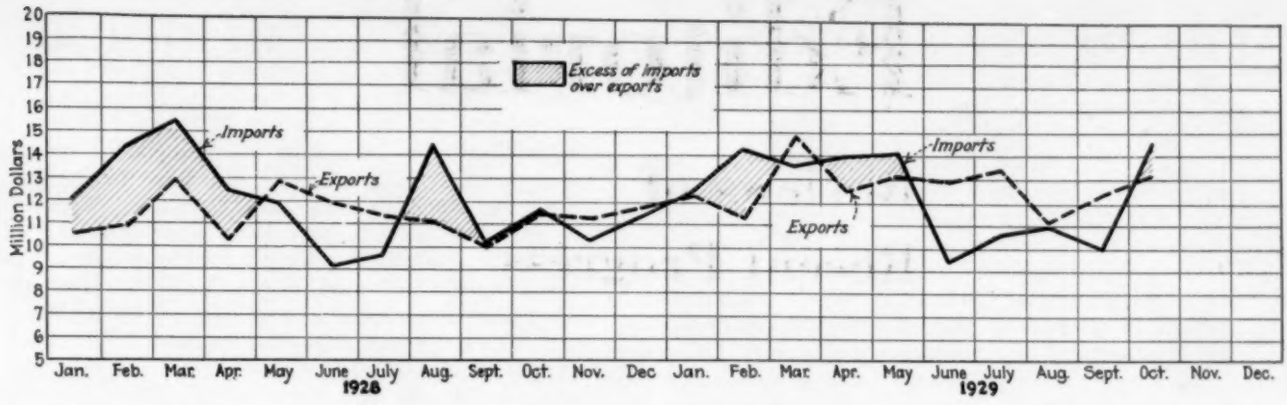
These developments and others of nearly equal importance, for example in plastics, where great gains were made by the phthalic anhydride-glycerol resins, indicate that the period just closed was one of no mean achievement. And yet views of the future, so far as we are permitted to see them, show this to be only part of the early infancy of the chemical age.

CHEM. & MET. *Estimates of* OUTPUT *of* BASIC CHEMICALS

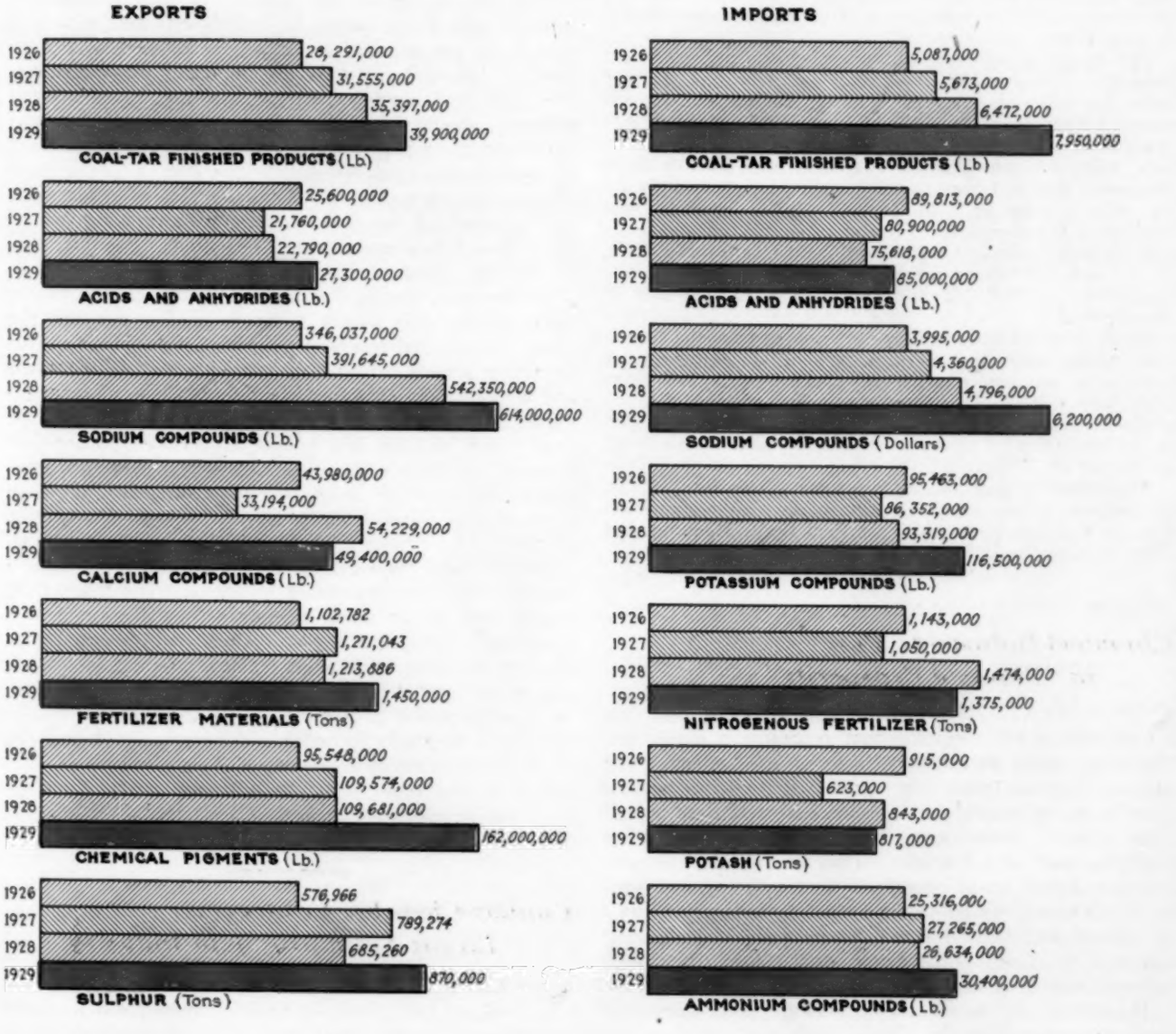


Activity in Consuming Industries





Foreign Trade in Chemical and Allied Productss



Editorial

Reviews of Recent Progress

THIS magazine, *Chemical & Metallurgical Engineering*, is the successor to *Metallurgical & Chemical Engineering*, which in turn, was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine* effected in July, 1906.

The magazine was originally founded as *Electrochemical Industry*, in September, 1902, and was published monthly under the editorial direction of Dr. E. F. Roeber. It continued under that title until January, 1905, when it was changed to *Electrochemical & Metallurgical Industry*. In July, 1906, the consolidation was made with *Iron & Steel Magazine*, that had been founded eight years previously by Dr. Albert Sauveur. In January, 1910, the title was changed to *Metallurgical & Chemical Engineering*, and semi-monthly publication was begun Sept. 1, 1915. On July 1, 1918, the present title was assumed and weekly publication was begun Oct. 1, 1919. Monthly publication was resumed in March, 1925.

Dr. E. F. Roeber was editor of the paper from the time it was founded until his death on Oct. 17, 1917. After a brief interim he was succeeded by H. C. Parmelee. Ten years later, Nov. 1, 1928, Mr. Parmelee was made editorial director of the McGraw-Hill Publishing Company and was succeeded in the editorship of *Chemical & Metallurgical Engineering* by Sidney D. Kirkpatrick.

The editorial staff of the magazine comprises: S. D. Kirkpatrick, editor; H. M. Batters, market editor; James A. Lee, T. R. Olive, R. S. McBride, Paul D. V. Manning, and Richard Koch, assistant editors.

[Published each year as a matter of record.]

Chemical Industries' Part in "Planned Prosperity"

STABILIZATION of American industry and the prevention of unemployment represent a major undertaking which all industry faces as 1930 opens. The idea of "planned prosperity" was first conceived with a view to using reserves of public construction as a pool from which to draw money and employment when other activities were at a low ebb. This conception, however, was not proved broad enough to satisfy the present situation. There is no evident reason why industry as well as government should not have its part in stabilizing business by doing construction and repair work with increased speed at times that threaten to be slack.

Rebuilding of chemical engineering plants occurs at very frequent intervals. This, with the attendant requirement of high depreciation charges, is a penalty of progress. No other group of industries carries such a burden in larger measure. Fortunately, however, research and engineering development under far-seeing and wise management has more than offset this burden of frequent rebuilding and has continued profits for chemical engineering enterprises in a large measure throughout both good and bad times.

Chemical enterprises are operated in large measure by skilled staffs which cannot be quickly replaced with new men if the personnel of a company is allowed to be scattered. Hence, it is extremely important in our industries that slack times, when they are met in even small measure, should be utilized for repair, rebuilding, and the formulation and carrying out of plans for expansion to meet the enlarged demands which always follow these periods of slowing down. This program of modernization, comprising the first concrete plan growing out of the National Business Survey Conference, is well worthy of vigorous action at this time.

Fortunately, chemical industries of the United States have suffered this winter in much smaller measure the effect of curtailed business than have most other manufacturing groups. This is in part due to the diversified and well planned structure created by technical management. But there has been some slowing down and the next three months are bound to include bothersome periods for many companies. However, there are generous surpluses on hand in most industries to carry through this period and insure an over-all good result in 1930.

During these three months it is important that valuable members of company staffs be utilized for inspection, repair, and design work whenever they can be spared from their operating duties. There will be no better time in which to have a general overhauling, a tearing out of old, and clearing of the way for new equipment. A vigorous period of house-cleaning and bettered housekeeping is decidedly in order. Managements should not think that this effort represents any extravagance. It is merely a sane investment of slack-time staffs in organizing for renewed and enlarged activity that is sure to come by mid-year.

Contact-Chamber Controversy Livens Sulphuric Acid Industry

SULPHURIC ACID enjoyed the largest year on record in 1929, with increased consumption in every important consuming industry. From a technical standpoint, the year was quiet, with little happening in the way of technologic advance. The only one noted was a contact converter intended for use with vanadium catalysts.

This was installed in a number of plants during the year. Its principal feature is said to be automatic temperature stability.

A recent estimate places sulphuric acid overcapacity of the country at about 40 per cent. The situation does not appear to be serious, however, for the estimate is based upon fairly intensive operation, and includes a large number of war-time chamber plants, considered obsolete by many authorities. This evidently accounts for the fact that new construction has not been heavy and was limited principally to contact plants.

What the situation actually is, regarding the efficiency of the older chamber plants, is a moot question. New intensive chamber systems have been developed in recent years and give excellent results. Opinion is prevalent in some quarters, on the other hand, that they do not improve greatly on the old style straight chamber. However, one thing is certain. Chamber plants are continually being made more efficient, by the substitution of ammonia oxidation equipment for other sources of nitrogen oxides. Recent information places the number of plants so equipped at more than fifty, accounting for perhaps 80 per cent of the total chamber acid production.

There is a strong tendency at present on the part of the consumer to make his own acid. Freight charges often are the determining factor while considerations of the strength of the acid he will require and that demanded by the buyers of his excess acid (as well as their location) have become the main criteria upon which the manufacturer is basing his decision between contact and chamber plant. According to one competent opinion, improvements in the former have greatly reduced or perhaps eliminated the difference in production cost.

Where Haste Prevents Waste

STRENUOUS efforts which the Department of Commerce is making to put the forthcoming Censuses of Manufactures and Distribution on a practical basis should have the cordial and active support of every manufacturer in the chemical engineering industries. In this era of keener and keener competition the producer and distributor need every scrap of operating and sales information they can possibly get hold of. Studies of the trends and shiftings of markets, balanced production and distribution, sales per employee, shipments, inquiries by buyers, prices, new orders placed, cancellations, collections, all bear directly on final profits and are essential to the success of any business.

But such data to be of practical use must be "hot off the griddle." Hence the call of the Bureau of the Census for greater co-operation on the part of the manufacturer and distributor for more accurate and timely reports of operations should receive wide approval. Dr. Julius Klein has put it this way: "The message is plain and easy—to educate the manufacturer and distributor to the necessity of rendering better and prompter returns than ever before, in exchange for which the Department of Commerce pledges itself to get out the results in better form and more promptly than ever before." Chemical industry has everything to gain and nothing to lose in such an exchange.

"The Plastic Age" in Prospect

WHAT GIVES the plastics industry its present flush of genuine health and what, at the same time, has underlain its almost geometric growth may be suggested by three factors: the accelerated demand for safety or "sandwich" glass; advances in resin-molding technique; and the development of more generally attractive (e.g., better looking, less hazardous) materials for every-day articles. Each of these factors has concerned the growth of essentially one type of product, once the price of the material in question had become as inviting as its performance. And of course, the price per pound is still entirely decisive in many cases of a choice within a group. The three factors cited by way of example, however, have resulted, respectively, in a potential automotive requirement of pyroxylin sheets amounting to over 20 million pounds annually, in a sudden multiplication of resin consumption for really sizable goods (such as beds, furniture, wall material), and in a fresh impetus to the production of the numerous everyday objects that strive to be pretty and useful. It is an industrial health which, if not nourished too fanatically, throws a most definite shadow of future greatness.

Pursuing these recent trends again, one is ultimately confronted by the rather elementary lesson that the plastics are not strictly competitive; that each material has some unique superiority which can be most profitably exploited. With the field then "wide open," the net outcome should be not a tug of war but a tandem. It will require all available types of plastics to satisfy the variegated demands for special properties, special colors and, where these are not desired, special prices. Frowning on newcomers who are decoyed by expired patents seems superfluous under present conditions; they either will "soon find out for themselves" or, if really technically capable, will aid in the generally upward swing. The most salutary advice for them, and, in passing, for the rejuvenated older producers too, would be to develop their product along the lines of its special promise and usefulness. By expending intelligent energy to this end, they will all derive gratifying returns from what promises to be, as a supplement to our era of metals, a true "Plastic Age."

Fuel for Power and Processing

INTENSIVE commercial exploitation of various fuels in the past year has led to a serious competitive relation among the various sources of heat and power available to chemical engineering industry. To some extent a further reduction in fuel prices has resulted, and certainly on all sides there has been an inroad on the margin of profit for the fuel producers.

Anthracite as an industry has perhaps suffered the most of any of the solid fuels, because there has been a continued shrinkage in total production and sales. This situation is of considerable concern to chemical engineering industries largely because of the competitive nature of several of the processed fuels. There has been a rapid and steady growth in the tonnage of byproduct

coke sold for house heating purposes. There has been a still greater percentage growth in the amount of manufactured gas so used. However, both of these developments, favoring further coke-oven erection, are seriously threatened by the tremendous inroads which are being made by natural gas, even in territory until very recently thought too remote from producing fields to be practicable of service. Industries have also been greatly benefited by the supplying of low-cost fuel in gaseous form through the extension of natural gas into wide areas not formerly served.

The big question for industries to consider studying fuel problems for the next few years will be, "Can we secure either natural gas, surplus coke-oven gas, or those byproducts of natural gas and petroleum refining which are now being utilized at low price levels in competition with solid fuel?" Every management should carefully consider this question in order to insure, either by direct arrangement or by contract with local public-utility agencies, the most efficient fuel supply possible. That there is a wide margin for improving the present situation in these respects is evident from the fact that nearly three times as much gas is available in the United States as is now being used through all the public-utility systems combined, and further development is indicated.

The petroleum industry and its affiliated natural-gas agencies will be particularly concerned in these developments. They not only have natural gas and natural-gasoline byproducts such as propane to dispose of; there are also large opportunities for supplying as industrial fuel the cracking-still gases now being used on a low-cost efficiency basis. If such development can go forward it will encourage further improvement of petroleum refining methods which can be accomplished if there be a profitable outlet developed for the still gases now utilized with relative inefficiency.

Improvement and Consolidation Brighten the Cement Outlook

PORTLAND CEMENT manufacturers did not enjoy 1929. With more than a plenty of overcapacity the industry nevertheless went ahead with the building of new plants in a manner difficult to understand. Meanwhile, cheap foreign cement—although inconsiderable in amount—made the year even more unpleasant.

The trend toward the wet-process plant remains. Only a few plants were built during the year to use the dry process, and those mainly in regions where water is scarce. Wet-process plants, it is pretty generally believed, permit closer chemical control and give a more uniform product at lower grinding cost. Still lower grinding costs evidently are in store for the wet-process operators through the application of closed-circuit grinding, a seemingly obvious step which has been in use in metallurgical plants for twenty years and in parts of chemical engineering industry for a shorter but exceedingly profitable period.

After much preliminary work a start on close-circuiting the cement industry was made in one plant which installed classifiers in 1929. Results were most encouraging, showing considerably increased grinding mill capacity and more than 60 per cent reduction in power required to grind the raw materials to 95 per cent through 200 mesh. At the same time the mill product was found to be more uniform than that formerly produced with ordinary compartment mills, and to burn more easily, yielding an excellent high-early-strength cement. It has been found that uniformity is more important than a very fine raw grind, much under 200 mesh.

An interesting sidelight on this year of mergers, and one which has come to pass since the late season slump put an end to most new merger plans, is a consolidation which may have a decidedly stabilizing influence on the cement industry. The largest factor in the steel business took over an enormous cement concern and thus acquires, according to a reliable estimate, fully 18 per cent of the cement capacity of American plants. In some quarters this move is seen as an attempt to put the tremendous financial resources of the steel producer behind the cement industry in hope of ending its disorganized state.

Advancement Is General in Clay and Ceramic Industries

GENERALLY speaking, the past year was regarded as good in the ceramic industries, although certain groups, notably pottery and the common brick industry on the Eastern seaboard, suffered from foreign competition, and the building materials manufacturers found their production exceeding consumption. Recession in this field, at least in the early months of 1930, is expected, as well, perhaps, as in certain other lines.

The year has not been without its improvements. A marked tendency toward the installation of continuous tunnel kilns is to be noted, especially in the production of heavy clay products, refractories, and whiteware. Coincidentally, kiln design has improved, resulting in greater fuel economy and better output. Machine-made terra cotta has been introduced, doubtless opening the way for considerable expansion in the use of this material as a substitute for other products. Mechanical formation, principally in hydraulic presses, is a definite trend in the refractories field, where fireclay, high alumina, magnesite, chrome and even silica brick are now being processed by this method. In the enamelling industry, electric furnaces of the continuous tunnel type have spread widely, with obvious advantage to the industry.

Products of the ceramic industries are showing trends as marked as those in processes. Perhaps the most interesting development in the heavy clay products industry is the preliminary production of light-weight structural units of burned clay. These are soon to be placed upon the market for tall buildings, soundproofing and insulating. The prediction has been made that buildings a

hundred stories in height will become practicable through use of this new product.

Other trends are evident. Face and enameled brick are enjoying a revival while super-refractories of silicon carbide, fused alumina, and zircon are on the increase. Insulating brick, refractory cements and the so-called "monolithic" firebrick have found widely extended use. Highly aluminous brick, such as those made from artificially prepared mullite and diaspore, have advanced decidedly both in production and application. In short, applied research has borne much fruit in the ceramics industries.

Synthetic Fiber and Film Forges Rapidly Ahead

REVIEW of the past year seems to give no evidence that the synthetic fiber industry has neared a saturation point. The world outlook was unfavorable late in 1928 and during the early part of 1929, with overproduction and dumping in Europe, and price cuts in the United States. Later months, however, improved the situation, so that optimism is now general. Four new American companies began production during the year while three of the older concerns opened new plants and others announced increased production facilities. Estimates place American production at one-third the world output with a 30 per cent increase in sight for 1930.

Cellulose acetate fiber has grown rapidly in popularity during the past three years. As a result three new acetate plants began commercial production during the year, slightly more than doubling previous capacity. Still another acetate plant is in prospect. In the opinion of one authority, however, this addition will just about bring acetate capacity in line with demand, and further construction is not expected in the near future.

Viscose rayon remains the unchallenged leader, accounting for fully 85 per cent of the production. Improvement in both wet and dry strength has been reported, while much greater improvement is in store if the much heralded Lilienfeld process lives up to its claims. This process, said to be in use experimentally by one large American producer, makes use of special viscose and a stretch-spinning process with a strongly acid spinning bath. The claimed increase in tenacity to three or four times that of ordinary viscose yarn would give it greater strength than natural silk. At least one viscose rayon manufacturer has arrived at the startling conclusion, however, that higher tenacity has not the paramount importance generally accredited to it.

Fine and multi-filament, delustered and low-luster rayons continue to have an important place in the scheme of things, with practically all manufacturers turning out some of these products. Two of the upsets of the year, however, have appeared in connection with special forms of fiber. Staple rayon, manufactured as such and not from waste, appears to have become relatively less important. So far as is known, only one American producer is in the field, and only to a small extent at that. The much advertised hollow fiber also has failed to come up to expectations. None is being made in the United States, and the imported product appears to have had a very cool reception.

New processes are in the wind, but nothing definite has appeared in this country. The Brandwood process, a British development intended to eliminate handling of the yarn by the use of a perforated bobbin on which the fiber is washed, desulphured, bleached, dyed, and dried, has several counterparts in American plants, all, however, in the experimental stage. A Franco-German product, butyrocellulose fiber, is not yet commercially developed and has made no bid for notice in the United States.

Cellulose film for wrapping purposes is going forward rapidly. The only American producer at present has added a second plant and doubled capacity within the past two years, at the same time perfecting and receiving patents on a method of waterproofing the film. It is now reported that a second company, affiliated with Belgian interests, is erecting a plant at Fredericksburg, Va., for the production of thirty million square yards per year. This industry, although less spectacular than its twin sister, viscose rayon, shows evidence of becoming an exceedingly important member of the cellulose group.

Paper Industry Demonstrates Its Appreciation of Science

WHILE the pulp and paper industry has been slow to recognize and to put its reliance on chemical engineering, it is now fully appreciative of its value. During the past year there have been important economic trends and engineering developments that speak well for the future of this great industry.

The Pacific Northwest is rapidly becoming more important as a producer of pulp and paper. Its mills are taking the lead in many technical and economic developments. A movement of considerable significance is the integration of sawmill, remanufacturing plant, power plant, and pulp mill to give profitable manufacture both of lumber and of pulp. This basic conception is gradually working back toward the East. The migration of the sulphite pulp industry, particularly of bleached pulp, to the Northwest continues.

Kraft manufacture continues to expand in the South, where wood, labor, and fuel are to be obtained at low costs. There is a continued shift from coarse papers to fine papers and specialties in the older and smaller mills of the North and East. The growing competition of agricultural and wood wastes as raw materials for the coarsest products, such as insulating board and corrugating board, is being felt by some producers.

The industry is rapidly recognizing that salable products can be produced from a wide variety of species of wood, other than the old standard ones. Western hemlock, Sitka spruce, the white firs and the hardwoods such as birch and maple are going into groundwood; various hardwoods and the pines into soda; and Douglas

fir, Western hemlock and tamarack into kraft. Recent experimental work has revived interest in demonstrating the suitability of the Southern pine for producing strong, easy bleaching alkaline pulps.

The sulphite process is undergoing many changes. Through a better understanding of the fundamentals of the process, as exemplified by the importance of the penetration period and the temperature schedule, a superior quality of products is being produced in constantly increasing yields. The weighing of wood and of chips and the metering of slush pulp is no longer a curiosity. Patented processes are increasing for conserving heat and sulphur dioxide. There is now a recognition of the non-uniformity of the digester contents, leading to a few plant installations of patented circulatory systems. This lack of uniformity is at present perhaps the most serious obstacle in the way of improved sulphite mill practice. The past year has witnessed an increased amount of interest, by the engineers in the sulphite industry, in corrosion-resistant alloys for piping, valves, strainers, pit bottoms, and gates. Favorable results have been obtained, in a preliminary way, from a new process for the recovery of sulphur and lignin from sulphite-waste liquor.

Further emphasis has been placed upon the alkali recovery plant as the principal field for the development of improved equipment in the alkaline process. Continuous rotary vacuum filters have replaced the old batch drainage and washing system in many mills, and the newer plants are equipped with continuous causticizing equipment, lime recovery kilns, and improved rotary incinerators or patented spray fed furnaces, both provided with efficient waste heat boilers. Circulatory systems for stationary digesters are being found in more and more mills, reducing steam consumption and improving uniformity of product.

For pulp bleaching the two-stage procedures are constantly replacing the older one-stage processes with various combinations of high and low consistencies. High consistency has proved to have certain definite advantages of decreased bleach and steam usage and improved color. The results, however, are much more sensitive to the process variables and stricter control therefore is required. The trend in bleaching plants is toward continuous operation as applied to the unit operations of filtration, mixing, and washing.

Decided progress has been made by paper machine builders, particularly in ease of changing the fourdrinier wire, in electrified sectional drive, in anti-friction bearings, in the use of new alloys in the construction of the parts, and in the improved mechanical water removal at the wet end. Among the other improvements for the production of cleaner, more uniform paper is the continuous centrifugal removal of dirt, slivers and other foreign particles in the pulp stream ahead of the paper machine. One new type of paper machine departs considerably from the present ones in that it does not have the long wire found on the fourdrinier and operates at much higher speeds than the present machines.

Other recent developments in the paper industry include the production of semi-chemical pulp for corrugating board from waste wood by a group of mills throughout the Southeast. A semi-sulphite process has been developed for the production of strong newsprint and wrapper quality sulphite in yields of 60 to 70 per cent by weight of the original wood. Scientific investigation by two research agencies of the permanence of various pulps and papers holds considerable interest both within and without the industry.

In many other ways the pulp and paper industry is demonstrating its appreciation of science. Fellowships have been established in a number of universities. The Forest Products Laboratory of Canada has recently been opened; and the Institute of Pulp and Paper Chemistry in Wisconsin has been backed financially by the paper industry of that state. There is evidence of further activity in improving equipment and processes and in establishing schools for the training of personnel in the science of paper making. Only in this way can the industry keep pace with the constantly increasing demands for better paper despite the rapidly diminishing supply of the present principal raw material.

All's Progress On the Western Front

CHEMICAL engineering industries on the Pacific Coast, characterized until the present time chiefly by wide diversification, may well point with pride to the marked expansion in already established lines of manufacture which took place in 1929 and which is planned for 1930. Business, so far as the chemical and allied industries are concerned, was unusually good during 1929, and if the recent stock market break has influenced the manufacture of chemicals, the West Coast has certainly been but lightly touched. The present year promises to be one of great expansion in chemical manufacturing.

The coast alkali industry, with the establishment of two new electrolytic plants in the Pacific Northwest and with the two causticizing plants and several soda ash plants already in existence prior to 1929, is now in a position to care ably for the demand for strong alkali. In the field of mild alkalis, borax has had its best year on record. Exports to foreign countries have been unusually heavy. Practically all of the world's boron materials are produced in California and even in the face of the largest annual production on record, the price has begun to advance somewhat, under the influence of new uses. Two more Eastern borax refineries were closed, the work being concentrated in California. Boric acid production has increased.

The paper and pulp industry is very well established in the Pacific Northwest and a continuance of its growth is to be seen. Work is in progress looking to the eventual establishment of rayon plants to utilize a part of the pulp output.

Bromine production increased markedly and 1930 will shortly see a third plant in operation. Chlorine produc-

tion also has expanded with the addition of the second and third electrolytic plants in Washington. Another halogen comes into prominence in United States production, through the manufacture of iodine from the waste brines of the southern California oil fields. This enterprise was definitely established in 1929.

Interest in chemical manufacture by the major oil producers is shown by the announcement of one company that a plant for the manufacture of synthetic ammonia is to be built in 1930. This plant also is to be located in southern California, giving strength to a remark by one of the country's prominent chemical manufacturers to the effect that southern California seems to be destined to be one of the really great refining centers.

One of the large Northwest smelters contemplates the establishment of a plant for the production of liquid sulphur dioxide. This is already manufactured in California for use in oil refining. Briquetting of non-coking coal using a sulphur-containing binder is being carried out in a Washington plant recently constructed at a cost of $175,000. The use of sulphur is also increasing, due to its advantages as a dusting insecticide.

Production of alginic acid and its salts as well as the best grade of agar agar now constitutes two well-established industries in San Diego. Other unusual products include a large production of several varieties of xanthates which are used in flotation work and as soil disinfectants. A large soap plant to be constructed in Los Angeles is also announced for 1930.

Altogether the past year has been a satisfactory one for chemical engineering on the Pacific Coast, and from first appearances, prospects for 1930 are even better.

Can the Petroleum Refiner Contribute More to Conservation?

PRESIDENT E. B. Reeser, of the American Petroleum Institute, in a recent statement attributed the present stabilization of the petroleum industry to the co-operative conservation policies now being carried out in the principal oil fields. He likewise praised the marketing branch of the industry for adopting a code of practice that should eliminate abuses in the selling end of the business. But he concludes his otherwise optimistic statement with one severe indictment. "The refining department," he said, "has not as yet taken advantage of a great opportunity to complete the cycle in the conservation of petroleum products. Leaders realize the wasteful practices of present refinery operations. Stocks of gasoline, for instance, are twice as much as they should be. I look forward to an early correction in this phase of the petroleum industry, and believe that 1930 will be a more prosperous year for the entire industry than 1929." That this is an indictment of management rather than technology is readily demonstrable.

The past year probably saw more basic technical advances than any comparable period in the history of the industry. The German coal hydrogenation process, perfected and adapted to petroleum refining by American chemical engineers, is a case in point. It appears to offer a solution for the basic problem of the industry in effecting an economic balancing of its products. By altering at will the chemical composition and properties of the intermediate and finished products, the refiner at last has a flexible tool not only for meeting the exigencies of the market but for controlling refining methods and ultimate quality. Three commercial petroleum hydrogenation plants were nearing completion in the United States at the close of the year, and after they have actually demonstrated their worth under American conditions, it has been announced that the process will be offered for license to other refiners, in order that the industry at large may co-operate in the further development. Surely this is a step toward constructive conservation.

Vapor-phase cracking, while still in its growing stage, is fast taking on the stature of another gigantic development. In addition to producing a superior motor fuel practically equivalent to benzol in its anti-knock characteristics, the process yields a rich gas that promises unusual opportunities for the refiner. A barrel of charging stock will produce 50 to 55 per cent of gasoline plus 1,100 to 1,200 cubic feet of dry gas with a fuel value of 1,700 B.t.u. For enrichment purposes the gas is almost ideal, since its high olefine content makes it an excellent carrier of naphthalene—one of the bugbears of the gas industry.

Vapor-phase still gases can be easily fractionated to yield ethylene, propylene or butylene which may be profitably marketed. It has been estimated that approximately 14,000,000 gallons of liquefied gases were manufactured and sold in the United States in 1929. Or, as is now being done, the olefines may be converted into glycol, acetone, or alcohols and their derivatives. The potentialities of such utilization may be gaged from the estimate that the present installations of the Gyro vapor-phase process alone could yield as much as 800 tons per day of ethylene gas. (To think of that quantity in terms of ethyl alcohol is beyond sober editorial reflection!) At present this gas will probably be converted to motor fuel by polymerization in auxiliary equipment, thus materially reducing the costs of operating the process.

These two developments are not by any means an inventory of the year's advances in refinery technology. Vacuum distillation as applied to the manufacture of lubricating oils has been making startling progress. Auxiliary stabilizing equipment is coming to be a regular part of cracking installations, in order to conserve the gases released from pressure distillates. For the same reason the lighter liquid fractions are now commonly stored in pressure tanks, thus preventing the waste of valuable vapors. Many other equally important refinements in process and equipment might be cited, but perhaps these are sufficient to show that the refining branch of the oil industry has been contributing its share of what is perhaps more constructive conservation than any artificial curtailment of production or agreement to eliminate marketing abuses. All, fortunately for the industry, are in the direction of even greater progress for the coming year.

Nitrogen

World Developments

By CHAPLIN TYLER
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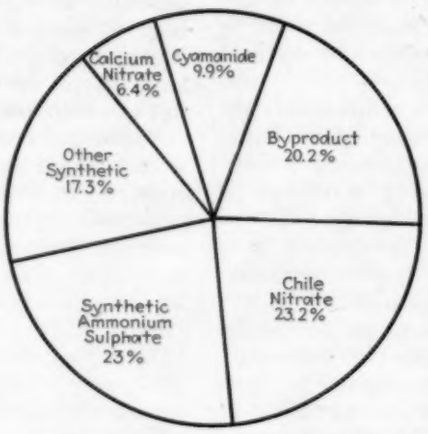
ACCORDING to the Ninth Annual Report of the British Sulphate of Ammonia Federation, Ltd., world nitrogen production during the fertilizer year 1928-1929 was 2,113,000 metric tons, which was an increase of 389,000 metric tons, or 22.5 per cent, over production during the previous fertilizer year. The following table shows the increase in production for the various forms of nitrogen:

	Increase in Production for year 1928-1929 over 1927-1928	
	Metric Tons Increase	Per Cent Increase
Byproduct sulphate of ammonia	8,000	2.2
Synthetic sulphate of ammonia	118,000	32.1
Cyanamide*	6,000	2.9
Nitrate of lime	31,000	29.5
Other forms of synthetic nitrogen	129,000	54.7
Other forms of byproduct nitrogen†	3,000	5.5
Chilean nitrate of soda	100,000	25.6
Total increase in production	389,000	22.5

*Except cyanamide made in Japan, which is calculated as synthetic sulphate of ammonia.
†Decrease.

During the fertilizer year 1928-1929, 20.2 per cent of the total nitrogen was byproduct nitrogen; 9.9 per cent was cyanamide nitrogen (excluding the bulk of the cyanamide made in Japan, which is calculated as synthetic sulphate of ammonia); 23.2 per cent was Chilean nitrate of soda; 23 per cent was synthetic sulphate of ammonia; 6.4 per cent was nitrate of lime; and 17.3 per cent was in other forms of synthetic nitrogen.



Distribution of World Consumption

It is notable that 46.7 per cent of all the nitrogen was produced through the synthesis of ammonia (except for several per cent produced in Norway by the arc process). Five years ago, during the fertilizer year 1923-1924, only 28.4 per cent of the nitrogen was so produced. Furthermore, the world production of nitrogen has doubled during the past five years.

During the past fertilizer year, consumption increased by 230,000 metric tons, or 14 per cent, over that in the year 1927-1928. The failure of consumption to keep pace with production is attributed largely to unfavorable agricultural conditions. However, it would appear that world production, particularly of Chilean nitrate of soda, and of synthetic ammonia, has increased too rapidly. It is believed that a continued increase in consumption of more than 10 per cent per year is an unreasonable expectation. The next two or three years, therefore, will be rather critical from the viewpoint of profits to the producers.

Three factors appear to underlie the present tendency toward nitrogen overproduction. First, the ambition of all major powers to become practically self-contained as to nitrogen supplies; second, the probable realization of the Chilean nitrate companies that it is "now or never" in the matter of profitable operation; and third, the ambition of many large producers of coke-oven gas to embark on the synthetic ammonia business. These factors are hard to suppress, since the position of each apparently is sound. Actually, if the world is to have a nitrogen crisis, it will come all the sooner because of the foregoing factors. Such a "shaking out" in the nitrogen business may be compared with the recent deflation of prices of securities.

International Cartel—Near the close of the 1928-1929 fertilizer year the I. G. Farbenindustrie announced the conclusion of a sales agreement with the Chilean Minister of Finance, Pablo Ramirez, representing the Chilean Nitrate interests and Imperial Chemical Industries, Ltd. This agreement is one of the most significant events in many years, since it unites the three largest factors in the world nitrogen

World Consumption of Nitrogen

Data for the fertilizer year 1928-29 as given in the annual report of the British Sulphate of Ammonia Federation, Ltd., converted to short tons of contained nitrogen.

	Ammonium Sulphate Equivalent	Chilean Sodium Nitrate	Calcium Cyanamide	Other Forms of Synthetic Nitrogen	Tota
Scandinavia, Russia, Baltic States, Germany United Kingdom, Holland, Belgium, France, Switzerland, Austria, Czechoslovakia, Hungary, Roumania, Jugoslavia and Bulgaria	445,000	185,000	176,000	318,000	1,124,000
Spain, Portugal, Azores, Madeira, Italy and Sicily, Egypt and other Mediterranean countries	86,000	68,000	14,500	24,500	193,000
Indian Empire, Ceylon, Phillippines, Straits, Dutch East Indies, Siam, Borneo, Japan, Korea and China	216,000	19,000	21,000	14,000	270,000
Africa (excluding Egypt) and neighboring islands	3,300	4,200	.....	800	8,300
United States, Canada, Central and South America West Indian Islands, Cuba, Puerto Rico and Hawaii	145,500	185,000	27,000	102,000	459,500
Australasia	5,200	1,800	.....	700	7,700
Total	901,000	463,000	239,500	460,000	2,063,500
Comparative figures for fertilizer year 1927-28	821,000	433,000	223,000	333,000	1,810,000

World Production of Nitrogen

Estimated by the British Sulphate of Ammonia Federation, Ltd., converted to short tons of contained nitrogen

	Fertilizer Year	
	1927-28	1928-29
Byproduct ammonium sulphate	405,000	414,000
Synthetic ammonium sulphate	404,000	535,000
Total ammonium sulphate	809,000	949,000
Cyanamide*	225,000	231,000
Calcium nitrate	116,000	150,000
Other forms of nitrogen from synthetic processes (including aqua ammonia)	260,000	402,000
Other forms of byproduct nitrogen (including aqua ammonia)	60,000	56,000
Chile nitrate	430,000	540,000
Total production	1,900,000	2,328,000

*Excluding the bulk of cyanamide made in Japan, which is included under synthetic ammonium sulphate.

business, to say nothing of the fact that the Chilean producers at last must have realized that synthetic nitrogen is a worthy and permanent competitor.

Coincident with the formation of the nitrogen cartel, which represented originally about 70 per cent of the world's production, the German Nitrogen Syndicate announced price reductions of at least 5 per cent and on some products much more. This announcement served to disarm those who would link the formation of the cartel with monopolistic objectives. In all probability, had the cartel not been formed, a price war would have ensued, with the Chilean industry and the synthetic ammonia producers as principal participants.

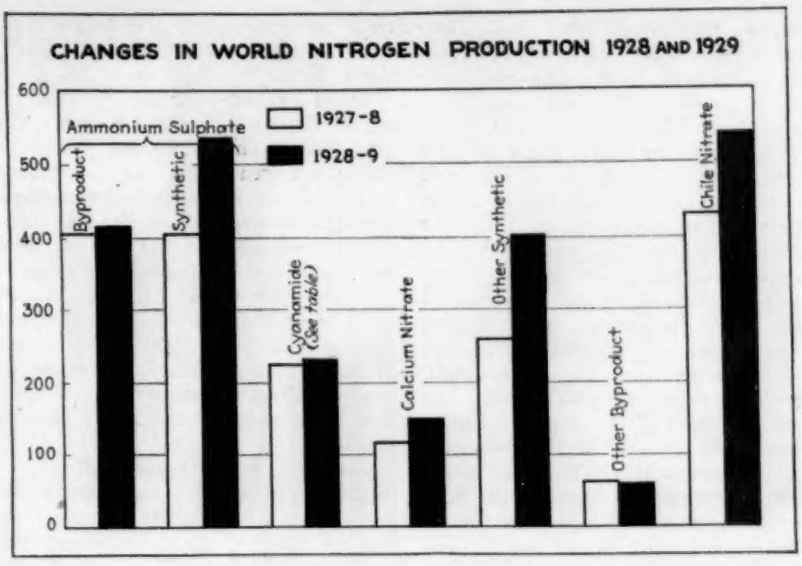
Chilean Nitrate — Aside from the trade situation, which is discussed elsewhere in this issue, the most important developments during the year have been the Guggenheim - Lautaro agreement and the participation of Chilean producers in the International Nitrogen Cartel.

The result of negotiations between the Guggenheim and Lautaro interests has been an agreement whereby the Lautaro company acquired rights to use the Guggenheim process, which is now in successful operation at the Maria Elena works of the Anglo-Chilean Consolidated Nitrate Corporation. The Anglo-Chilean Company will erect for the Lautaro company a plant of 540,000 tons capacity, which will supersede the Shanks process plants. The new project was financed by an issue of $32,000,000 6 per cent first mortgage bonds, secured by the plants and nitrate properties of the Lautaro company.

Upon completion of the new plant, the combined capacity of the Anglo-Chilean and Lautaro companies will be more than 1,000,000 metric tons of nitrate annually, or approximately the present requirements of the United States.

On Sept. 16 the shareholders of the Lautaro Nitrate Company approved an increase in the capital from £8,000,000 to £14,500,000 by the creation of 2,000,000 common 1-shilling shares and 320,000 7 per cent $100 shares. The common shares are held by the new Delaware corporation, and the $100 shares were created to provide for the conversion rights of the recent $32,000,000 bond issue. In reply to criticism of the arrangement with the Anglo-Chilean Consolidated Nitrate Corporation, J. Hunter, who presided over the meeting on Sept. 16, explained that if the company had not obtained the new nitrate properties, they would have been acquired by the Anglo-Chilean Corporation, "who would have put up an oficina making nitrate at 30s. to 35s. per ton cheaper than us, and make it impossible for us to make profits with our existing oficinas."

Mr. Hunter pointed out that while the cost of production (by the Shanks process) was 5s. per ton lower today than when a 15 per cent dividend was paid, the selling price was 30s. per ton lower. A loss of 25s. per ton on the Lautaro sales amounts to about £750,000, which is equivalent to a 10 per cent dividend. By the new scheme the directors hope to reduce their cost by 30s. to 35s. per ton. Thus there would appear to be ample reason for the adoption of the "Guggenheim process" now in successful large-scale operation at Oficina Maria Elena.



In view of the extremely rapid developments in the field of ammonia synthesis, the future financial results of the Lautaro and Anglo-Chilean companies will be followed closely by holders of the bonds.

Nitrogen Fertilizers — During the past year much progress has been made in the development and demonstration of nitrogen fertilizers. In the United States, the treatment of superphosphate with ammonia is now practiced generally by all of the more important fertilizer manufacturers. Not only are the savings in fertilizer production cost substantial but the improvement in physical properties is marked when ammonia is introduced into the fertilizer mixture. While aqua ammonia is used extensively in commercial practice, it has now been proved that anhydrous ammonia is fully as effective as aqua in the treatment of superphosphate.

It is believed that during the fertilizer year 1929-1930 at least 35,000 tons of ammonia will be used in the treatment of superphosphate. This is equivalent to the nitrogen contained in 140,000 tons of sulphate of ammonia or in 185,000 tons of nitrate of soda.

In England, successful demonstrations have been made with the new top dressing "Nitro-Chalk," manufactured by Synthetic Ammonia & Nitrates, Ltd. Nitro-Chalk will no doubt compete with Chilean nitrate as a top dressing.

In Germany the I. G. has developed "Cal-Nitro," a top dressing similar in composition to Nitro-Chalk. Cal-Nitro is expected to be marketed in large quantity during the year 1930. Presumably the Germans have learned that calcium nitrate is not an entirely acceptable substitute for Chilean nitrate. and are therefore casting about for something that has better properties. It is significant that only a part of the output of the new works of the Norsk-Hydro (now controlled by the I. G.) will be calcium nitrate. It is understood that the principal product of the Norsk-Hydro works will be "Nitrammonkalk," said to be a mixture of ammonium and calcium nitrates.

While the trend of the past year has been toward fertilizer materials of greater concentration, much research remains to be done in order to determine the best combinations of compounds for the various concentrated mixtures. Thus the introduction of concentrated fertilizers will affect the course of field work carried out by the various state experiment stations.

The intense interest in various processes for producing phosphoric acid is an indication that the future output of ammonium phosphates must be increased enormously. In fact, it is quite reasonable to expect that the ammonium phosphates, "treble" superphosphate (and possibly citrate-soluble calcium phosphates) will in time displace a large part of the market now occupied by ordinary superphosphate.

Germany — In Germany the independent nitrogen plants continue to flourish. The "Gaveg," which is 60 per cent controlled by the Mont-Cenis company and 40 per cent by the Bergwerks A. G. Hibernia, is the second largest fixed nitrogen enterprise in Germany. The present plant capacity of 40,000 metric tons of nitrogen per year is to be increased to 50,000 metric tons during 1930. Besides the principal products, Montansaltpeter (am-

monium sulphate-nitrate) and ammonium sulphate, Gaveg produces for sale anhydrous ammonia and ammonium nitrate.

During 1929 construction was begun on a synthetic ammonia plant for the Gewerkschaft Ewald in Westphalia. This is the fifth and most recent of the synthetic ammonia ventures owned or controlled by the coal companies, the other four companies being the Mont-Cenis - Hibernia concern, mentioned above; the Ruhr-Chemie, A. G., having an output of about 20,000 metric tons of nitrogen per year; the Wintershall-Kloeckner combine, also having an output of about 20,000 metric tons of nitrogen per year; and the projected Stickstoffwerke A. G. Waldenburg, which is reported to have started construction on a plant to produce 15,000 metric tons of nitrogen per year. Thus it is clear that by the end of 1930 the capacity of the five synthetic ammonia projects outside of the I. G. works will be about 100,000 metric tons of nitrogen per year.

ASSUMING that the I. G. production of Merseburg and Oppau will be about 600,000 metric tons of nitrogen, the total German production for the calendar year 1929 is estimated to be about 830,000 metric tons of nitrogen, as follows:

	Metric Tons
Oppau and Merseburg	600,000
Cyanamid works	80,000
Byproduct coke works	90,000
Ruhr Coal Works	60,000
Total	830,000

Of this total, it is believed that 425,000 tons was consumed by German agriculture, 100,000 tons by German industry, and not more than 250,000 tons was exported. This leaves a net increase of stocks on hand of 55,000 tons. That stocks of nitrogen have been increasing in Germany there can hardly be a doubt. While sales of nitrogen products have been satisfactory, new construction of ammonia synthesis works has proceeded at an unduly rapid rate. This condition has caused considerable uneasiness among chemical securities, particularly that of I. G. common shares. The I. G., however, has denied vigorously that the recent fall in the price of its shares is justified by the facts. The company claims that profits are unimpaired, despite increased wage rates and decreased prices obtained for some principal products, notably nitrogenous fertilizers.

It should be realized that the I. G. is in a position to curtail production without seriously affecting its financial position, since the Oppau works in particular must have been thoroughly amortized several years ago. The newer companies in the nitrogen business unquestionably are saddled with much higher fixed charges than is the I. G.

Great Britain—During the past year Great Britain has become, more than previously, an important factor in world nitrogen trade. In the calendar year 1928 it is estimated that Great Britain produced about 145,000 metric tons of nitrogen, 55,000 tons of which was produced through the ammonia synthesis (see *Chem. & Met.*, January, 1929, page 39). It is estimated that in the calendar year 1929 Great Britain produced approximately 190,000 metric tons of nitrogen, about half of which was produced through the ammonia synthesis.

Canada—Although the total sales of fertilizers in Canada amount to little more than $10,000,000 per year, this has not deterred the Consolidated Mining & Smelting Company of Canada from embarking on a fertilizer project at Trail, B. C. The initial units are to cost about $8,000,000, according to published estimates, and will produce 35 tons of fixed nitrogen daily in the form of fertilizer salts. The hydrogen for ammonia synthesis will be produced electrolytically in a plant requiring 20,000 hp. The liquid air and other plants will require a further 10,000 hp. Since the company has phosphate rock deposits and is a large producer of sulphuric acid, it is believed that ammonium phosphate will be produced. Apparently the company hopes to market much of the fertilizer in Canada, since it is not in a particularly strategic position with respect to possible foreign markets.

Another important Canadian development is the expansion of the Niagara Falls plant of the American Cyanamide Company up to a reputed capacity of 355,000 tons of cyanamide per year, a large part of which will be shipped to the New Jersey works of the company for conversion to "Ammophos."

SINCE fully half of the fertilizers used in Canada comes from the United States, the announcement that Canadian Industries, Ltd., will produce fertilizers on a large scale is significant. According to the program, plants for the manufacture of superphosphate and mixed fertilizers will be erected at Hamilton, Ontario, and Beloeil, Quebec. During the fall of 1929 it was also announced that Canadian Industries, Ltd., would erect a small synthetic ammonia plant at Windsor, Ontario, to utilize the byproduct hydrogen of the Canadian Salt Company., Ltd., which has been acquired by Canadian Industries, Ltd. It is reported that the Casale process will be used.

Norway—During the summer, production was begun at the synthetic ammonia plants of the Norsk-Hydro at Rjukan and Porsgrund. The electrolytic hydrogen plant at Rjukan is said to require 150,000 hp. The ultimate capacity of the plants is said to be equivalent to 83,000 metric tons of nitrogen per year, which will be marketed in the form of calcium nitrate ("Norway saltpeter") and calcium-ammonium nitrate ("Nitrammonkalk"). According to recent advices, the completion of the Norsk-Hydro plants is being delayed on account of the anticipated overproduction of nitrogen fertilizers during 1930. It is interesting to note that the present synthetic ammonia plants will supersede the arc process plants, which have operated successfully for about one-quarter of a century. Thus the arc process will, practically at least, become a matter of chemical history.

Netherlands—In the Netherlands, three nitrogen plants are in process of construction, all of which will utilize coke-oven gas. The state plant at the Maurits Mine, in the Limburg coal regions, is planned to have a capacity of 20,000 metric tons of nitrogen, to be marketed in the form of sulphate of ammonia.

ANOTHER plant is being erected at Ijmuiden, a joint venture called the "Company for the Exploitation of Coke-Oven Gases," owned by the Royal Dutch Blast Furnaces & Steel Factories, and the Bataafsche Petroleum Company, a subsidiary of the Royal Dutch Shell Company. The plant will have a capacity of 14,000 metric tons of nitrogen, to be sold as sulphate of ammonia, phosphate of ammonia, and nitrate of lime.

The third plant now under construction is at Sluiskil, in Zeeland. It will have a capacity of 40,000 metric tons of nitrogen in the form of sulphate of ammonia. A new company, said to be the Netherlands Nitrogen Company, has been formed to operate the Sluiskil plant, which is being promoted by the Montecatini-Coppée interests.

South Africa—During the summer considerable excitement was caused by reports of the discovery of extensive nitrate deposits in South Africa. The deposits are said to be distributed over an area of at least 10,000 square miles, and the average analysis of the caliche (as given by Prof. J. Smeath Thomas before the British Association in Capetown) is 16 per cent nitrate of soda, 1.5 per cent of potassium chloride, 5.5 per cent of sodium chloride, 5.3 per cent of sodium sulphate, and 0.8 per cent of calcium bicarbonate, the rest being clay, gravel and sand.

Since the deposits are about 300 miles from the coast, and since the partly depleted Chilean deposits would appear to be more attractive than the newly discovered African lands, it is unlikely that the existent nitrogen industry will be affected, even slightly. Alaskan coal probably is more attractive commercially than is the South African nitrate.

Nitrogen

Situation in U.S.A.

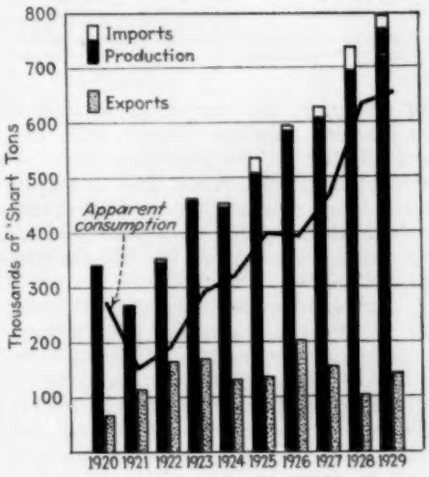
Editorial Staff Interpretation

INDUSTRIAL nitrogen supply in the United States has been undergoing radical change during the last six months. The changes which have occurred are of the type that have been forecast in earlier reports and articles, but they have taken place at a rate which apparently is much faster than anyone would have anticipated a year or two ago. It seems worth while, therefore, to make brief appraisal of the facts and the trends.

Synthetic Ammonia—Production of synthetic ammonia in the United States is going on actively in seven plants. At the end of 1929 it is estimated that these plants had a total daily production of 370 tons of ammonia per day. During the calendar year 1929 the plants operated on the average at a rate of approximately 280 tons of NH_3 per day. As a consequence, the 1929 production of synthetic ammonia was approximately 102,000 short tons of NH_3. This output is more than three times that in the preceding calendar year.

BY Jan. 1, 1930, capacity at Hopewell, Va., was sufficiently increased so that the rated capacity of active plants was in excess of 500 short tons of NH_3 per day. Reliable forecasts as to the plans and expectations of the Allied Chemical & Dye Corporation and the duPont company's subsidiaries would indicate that the actual production in 1930 of synthetic ammonia will be at least 150,000 tons and probably will approximate 180,000 tons. Of this total a substantial part will, of course, not go into the market as ammonia, ammonium sulphate or other ammonium salts, but will be marketed as synthetic sodium nitrate from Hopewell. The rate of expansion of the synthetic ammonia business will depend more on the commercial desires and the administrative decisions of Allied and duPont executives than on any technologic factor.

There are in the United States at the present time actually operating seven synthetic ammonia plants. The first and third of these in order of size are owned by the Atmospheric Nitrogen Corporation, a subsidiary of the Allied Chemical & Dye Corporation, located at Hopewell, Va., and Syracuse, N. Y. The second plant in order of size is that of the DuPont Ammonia Corporation, at Belle, W. Va. The four smaller works are owned and operated by the Mathieson Alkali Works, at Niagara Falls; Roessler & Hasslacher, at Niagara Falls; the Pacific Ammonia Company, at Seattle, a subsidiary of the duPont company; and Great Western Chemical Company, at Pittsburgh, Calif. To utilize the hydrogen of the Dow Chemical Company a plant is now under construction at Midland, Mich., which is reported to have a capacity in excess of 10 tons of ammonia per day. The owner of this plant, which is reliably stated to be other than the Dow Chemical Company, has not been disclosed, but is believed to be Roessler & Hasslacher.



Production, Imports, Exports and Apparent U. S. Consumption of Ammonium Sulphate.

It is reliably reported that the Shell oil interests have actually undertaken the building of a synthetic ammonia plant in the Los Angeles district, California; the plans, character, and capacity of this plant apparently have not been announced as yet. It has been rumored from time to time that the American I. G. Chemical Corporation was to build a synthetic ammonia plant either near Monroe, La., or on the Warrior River, in Alabama. It is believed that this report will not be confirmed unless the I. G., confronted by increased tariffs on nitrogen (which are highly improbable), should find it more economical immediately to undertake manufacture in the United States of products now made in Germany.

The seven working plants can be briefly described as to present and prospective capacity and average rate during 1929 as follows:

	Output at End of 1929	Approximate Capacity, January, 1930	Average Operating Rate in 1929
	(Expressed in tons of NH_3 per day)		
Hopewell	200	300	150
DuPont	100	150	70
Syracuse	40	40	40
Mathieson	15	15	12
Roessler & Hasslacher	8	8	4
Great Western	4	4	2
Seattle	3	3	3
	370	520	281

Chilean Nitrate—During 1929 the operations of the Chilean nitrate industry were for about six months at a higher rate than during the preceding year. Regardless of market requirements, and seemingly contrary to good business judgment, the production during the first half year was about 8 per cent above that during the corresponding period of 1928. Since July, however, each month's production has been less than that of the corresponding period of 1928, and it appears that the production for the year as a whole was almost exactly identical with that of 1928; namely, 3,250,000 metric tons.

EXPORTS of Chile nitrate were 10 per cent greater for the first ten months of the year than in the corresponding months of 1928; but exports during the early winter have declined and it appears that the year's total will exceed that of 1928 by only 5 or 6 per cent. Such export does not, however, actually represent sale and consumption.

Sources of Chemical Nitrogen Used in the United States in 1927, 1928 and 1929
(Quantities in Short Tons of Nitrogen Contained)

	1927	1928	1929
Production:			
At coke works	147,700	164,500	183,000
At gas works	6,200	6,500	6,000
From the air	18,000	27,000	84,000
Bone distillation, etc.	200	200	200
Total production	172,100	198,200	273,200
Imports:			
Ammonium sulphate	3,900	9,600	6,000
Ammonium-sulphate-nitrate	13,000	23,800	4,000
Calcium cyanamide	26,000	32,300	45,000
Calcium nitrate	3,100	3,900	5,000
Chile nitrate	130,000	179,200	160,000
Cyanides	4,800	5,500	6,000
Miscellaneous ammonium compounds and nitrates	4,600	5,700	5,000
Nitrogeneous fertilizer mixtures (estimated)	6,000	9,000	8,500
Total imports	191,400	269,000	239,500
Grand total available	363,500	467,200	512,700
Exports:			
Ammonium sulphate	32,400	21,400	30,000
Sodium nitrate	2,200	3,200	2,000
Anhydrous ammonia	500	800	1,100
Other nitrogen compounds	2,000	10,000	11,000
Total exports	37,100	35,400	44,100
Apparent U. S. consumption	326,400	431,800	468,600

U. S. Production, Imports, Exports and Apparent Consumption of Ammonium Sulphate

Year	Production of Byproduct Ammonium Sulphate (Short Tons)	Production of Byproduct Ammonia and Ammonia Liquor as Short Tons of Ammonium Sulphate	Imports (Short Tons)	Exports (Short Tons)	Apparent U. S. Consumption of Ammonium Sulphate (Short Tons)
1920	337,908	131,555	2,233	66,714	273,427
1921	264,319	64,182	5,238	114,928	154,629
1922	347,772	101,465	5,477	165,011	188,238
1923	457,963	117,400	3,964	171,118	290,809
1924	446,564	98,058	6,720	132,571	320,713
1925	508,507	130,511	26,613	137,918	397,202
1926	583,930	107,046	9,392	202,860	390,462
1927	608,071	109,389	19,211	155,335	471,947
1928	693,948	104,939	42,133	104,177	631,904
1929*	770,000	120,000	25,000	140,000	655,000

*Estimated by *Chem. & Met.*; all other data from the Department of Commerce. Although the production of byproduct ammonia liquor is tabulated, it is not taken into account in computing the consumption of ammonium sulphate.

The visible world stocks have increased by 25 per cent as of Dec. 1, compared with Dec. 1 of the preceding year, or by approximately 460,000 metric tons. Hence, it would appear that the actual consumption or sales to ultimate consumers must have decreased by approximately 450,000 metric tons, or about 17 per cent of the present rate of world annual consumption. The imports into the United States during the first ten months of 1929 were about 9 per cent—80,000 metric tons—less than the same period in the preceding year. Thus it is evident that a decrease in sales or consumption elsewhere in the world has been an even larger factor than the decrease in the United States imports in creating enlarged world stocks.

The world stocks of Chilean nitrate as of Dec. 1, 1929, are reported by the Department of Commerce representative in Chile as 2,455,000 metric tons. This figure represents an extravagant and unwarranted accumulation of nitrate, especially in view of the constantly increasing strength of competition which synthetic products are offering. It is about 23 per cent greater than the stocks reported at any corresponding season for several years past and 30 per cent above those excessive stocks of 1926 which initiated the collapse in nitrogen prices of 1926-27. It indicates that the producing interests of Chile have not been able to cut their operations to a point corresponding with real world requirements and that sooner or later we shall have another drastic readjustment comparable with that suffered about two years ago. It is not unlikely that this readjustment will come only through distress sales at unwarrantably low prices, which will in turn occasion unwarrantably low prices for such nitrogen products as synthetic sodium nitrate, ammonium sulphate, and the imported competing nitrogen carriers, Nitrophoska and ammonium sulphate-nitrate.

Byproduct Ammonia—Production of byproduct ammonium sulphate in the United States was at an unprecedented rate in 1929. During this period the processing of coal at byproduct coke ovens was at a rate more than 11 per cent in excess of that which prevailed during 1928, which period afforded the previous all-time record for byproduct coke operations. As a consequence, even though coke-oven operations did slow down slightly during the last quarter of the year, the output of byproduct ammonium sulphate during 1929 exceeded that of the preceding year by more than 11 per cent. The output as ammonium sulphate or as liquor and anhydrous calculated as sulphate equivalent was approximately 890,000 net tons of $(NH_4)_2SO_4$.

Use of byproduct ammonia as liquor or in anhydrous form for treatment of superphosphate has been discussed in *Chem. & Met.* recently (article by R. S. McBride, page 592, October, 1929). There are no accurate data to indicate exactly what the influence of this development has been upon the proportion of byproduct ammonia which has been marketed as sulphate and that which has been marketed either in liquor or anhydrous form. Certainly, however, the influence of the development is going to be noted in an increase of liquor and anhydrous sales; this influence has been taken into account in the estimates of the accompanying table which relate to the United States production and consumption of ammonium sulphate as such.

Exports of Sodium Nitrate from Chile—1928

	Metric Tons	Per Cent of Total
Great Britain or Continent (by orders)	1,243,772	44.4
United States	1,035,621	37.0
Egypt	107,969	3.9
Japan	70,724	2.5
France	70,460	2.5
Hawaiian Islands	57,519	2.1
Mediterranean countries	37,518	1.3
Great Britain (direct ports)	34,397	1.2
South Africa	25,756	0.9
Germany	25,120	0.9
India	12,605	0.5
Spain	11,950	0.4
Russia	10,903	0.4
All other countries	56,092	2.0
Total shipments	2,800,406	100.0

Imports and Exports—During 1929 the drop in imports of nitrogenous fertilizer materials was most conspicuous in Chilean nitrate, a point already discussed. There also was a very large decline in the imports of ammonium-sulphate-nitrate, from approximately 78,000 to about 14,000 long tons, and a smaller percentage drop in ammonium sulphate imports, from about 29,000 to 17,500 long tons comparing figures for the first ten months of the year only. These declines in imports were in a small measure offset by the increases in cyanamide and calcium nitrate imports from 108,000 tons and 21,000 tons during the first ten months of 1928 to 146,000 tons and 28,000 tons, respectively, in the corresponding period of 1929. Considering imports alone, there was actually a decline in the supply of inorganic nitrogen amounting to a considerable percentage as compared with the preceding year, but not a large percentage when one figures the decline on the basis of the total available inorganic nitrogen, including domestic production.

Exports of nitrogen from the United States increased during 1929 as compared with 1928, particularly because of the increased foreign market found for ammonium sulphate. Official figures show that 115,000 long tons of this byproduct was exported in the first ten months of 1929 as compared with 81,000 long tons in the corresponding months of 1928. The influence of these factors on the inorganic nitrogen supply of the United States is most easily seen from the tabular summary of sources of nitrogen given on the preceding page. From that tabulation one discovers that the decline in nitrogen available from foreign sources less exports decreased by an amount which is less than half of the increase in the output of nitrogen products at American synthetic plants. Hence, although an accurate statistical analysis must take account of these changing imports and exports, they are in a broad sense less important to the domestic consuming industries than are the current changes in production of nitrogen products at synthetic plants.

A consideration of all factors affecting the American nitrogen situation discloses the very interesting fact that there has been a steady increase in consumption of nitrogen in the United States, mainly in fertilizers. This point has been overlooked by many, who have given consideration only to fertilizer tonnages and have failed to take into account the rapid and substantial increase in the concentration of nitrogen in the mixed and complete fertilizers marketed during recent years. This point is discussed at greater length in the section of this issue of *Chem. & Met.* which deals with fertilizers.

Production, Exports and World Consumption of Chilean Nitrate

Year	Production (Thousands of Metric Tons)	Exports from Chile (Thousands of Metric Tons)	Imports into the U. S. (Thousands of Metric Tons)	World Consumption (Thousands of Metric Tons)
1923	1,904	2,266	892	2,150
1924	2,406	2,363	987	2,200
1925	2,520	2,517	1,112	2,350
1926	2,016	1,614	914	2,100
1927	1,611	2,375	749	1,800
1928	3,163	2,801	1,033	2,500
1929	3,250	2,950	950	2,700

All data from U. S. Department of Commerce except those for 1929, which are estimated by *Chem. & Met.* and "Consumption" data, which are from estimates of British Sulphate of Ammonia Federation for "fertilizer" years, ending on June 30 of each year shown.

Coal Processing

Yields New Gains In Production

COKE PLANTS formerly could be studied almost exclusively in their relation to the steel industry, with but slight attention to the city-gas problems involved. Now the situation has become much more complicated. The total production of coke does, to be sure, depend largely upon the demand for this material in the blast-furnace industry. But city-gas requirements, household uses of coke, and even such remote matters as natural gasoline and petroleum cracking-still gases are really significant.

Growth in the industries which depend on the processing of coal has continued during 1929 along conventional technical lines. Low-temperature carbonization seems to have been shown by the experience of the past year to be a complete economic failure under American conditions at the present time. All of the experimental works seem to have suffered serious setbacks and it appears that none of them is now operating on any basis that might be termed even semi-commercial.

The failure of the economic experiment in low-temperature processing of coal at New Brunswick, N. J., which has been described in *Chem. & Met.* in considerable detail, proved a very serious burden on the parent company fostering this enterprise. It is evident that the technical difficulties of operating the K-S-G retort with American coals have proved to be much greater than anticipated, and some who have carefully studied this process believe that it is not of a type that can be successfully used with such American coal as is otherwise suited to the making of byproducts in good yield and of desired quality. Furthermore, it is evident that with the coals so far tested, it is not practicable to make a solid fuel which will command a favorable market price for household heating without further processing into briquets. And finally, it is probably safe to conclude that low-temperature tar or tar oil is worth on the American market no more than its equivalent fuel value, except for very limited applications.

In view of the disappearance of low-temperature carbonization from the foreground of interest, attention should be directed in quite another direction. There are equally interesting and much more important possibilities developing in the relationship between the byproducts of petroleum refining and the byproducts of natural gasoline making. These are going to have a serious economic impact upon the whole structure of city-gas and coal-byproducts supply. They are discussed at considerable length and an attempt is made to appraise them in proper relation to coke, gas, and city fuel supply on the ensuing pages.

There has never before been a time when the interlock of the fuels and the energy resources of the United States was so intimate. Nor has there ever been a time when changes in source of energy and fuel have been taking place so rapidly or with the potentiality of so great an economic advance, and even serious disturbance of present profitable operation.

Coke

Sets Record

BYPRODUCTS and coke made at coal-processing plants in the United States during 1929 require for their description the usual assortment of superlatives. The output during the year of coke, gas, tar, light oil, and ammonia was the largest ever recorded in the history of the industry, amounting to approximately 11.3 per cent greater total in 1929 than in 1928, which was the previous record year.

The combined production of byproduct and beehive coke exceeded that of the preceding year by 13.2 per cent. Of the total production 90 per cent was from byproduct ovens and 10 per cent from beehive ovens.

The increase in beehive coke production was 33 per cent over 1928, but even with this large increase, the total production of 6,000,000 tons was smaller than in any preceding year since 1886, except the disastrous year 1921 and in 1928.

Activity of general industry, creating unusual steel requirements, of course was the major factor in stimulating coke production during the year. Despite the general slackening of business, experienced in some lines as early as August and September, there was not a material falling off in daily rate of coke production at byproduct plants until November. And early returns for December indicate that the recession has not progressed far. Beehive coke was somewhat curtailed as early as August, and by December was reduced to less than 60 per cent of the mid-year rate which slightly exceeded 600,000 tons per month.

Best available forecasts seem rather convincing that the steel industry has

Byproduct Coke Industry in 1929

(Estimates by Chem. & Met., based on 11 monthly reports of Bureau of Mines)

Plants operating at end of year	87
Ovens at end of year	12,750
Capacity, coke per year	59,000,000 net tons
Production	53,800,000 net tons
Increase over 1928 in production	11.3 per cent
Total coke from byproduct plants	90 per cent
Byproducts produced	
Gas	850,000,000 M cu.ft.
Tar	705,000,000 gallons
Ammonium sulphate (equiv.)	890,000 tons
Crude light oil	210,000,000 gallons

Consumption of Coking Coal at By-product Plants, as Reported to U. S. Bureau of Mines

Region	Net Tons Consumed Jan.-Nov. 1928	1929	Increase Per Cent
New England	1,263,655	1,753,977	38.8
Middle Atlantic	26,129,009	28,643,047	9.6
Ohio	10,187,987	11,486,237	12.7
Southern Michigan	3,027,457	3,484,041	15.1
Illinois-Indiana	11,641,190	13,548,335	16.4
Lower Missouri Valley	276,399	287,935	4.2
Lake Dock Territory	1,512,682	1,792,682	18.5
Southeast	8,104,629	8,886,133	9.6
Mountain and Pacific	1,228,194	1,232,290	0.3
	63,371,202	71,114,677	12.2

Byproducts Obtained from Coke-Oven Operations in 1928

(Data from U. S. Bureau of Mines)

Product	Production	Sales — Quantity	Sales — Value — Total	Sales — Value — Average
Tar (gal.)	631,844,767	332,150,270	$17,544,797	$0.053
Ammonia (lb.):				
Sulphate	1,387,895,214	1,318,369,804	24,826,744	.019
Ammonia liquor (NH_3 content)	52,469,456	52,584,975	2,513,312	.048
Sulphate equivalent of all forms	1,597,773,038	1,528,709,704	27,340,056	.....
Gas (M. cu.ft.):				
Used under boilers, etc.	775,512,939*	18,620,112	1,132,547	$0.061
Used in steel or affiliated plants		286,132,946	31,509,424	.110
Distributed through city mains		125,131,465	39,935,641	.319
Sold for industrial use		24,588,049	3,921,245	.159
		454,472,572	$76,498,857	$0.168
Light oil and derivatives (gal.):				
Crude light oil	188,597,956†	10,334,813	$1,158,846	$0.112
Benzol, crude and refined	21,451,748	21,452,973	4,215,752	.197
Motor benzol	103,051,900	102,935,995	16,832,646	.164
Toluol, crude and refined	16,097,856	16,181,650	5,513,624	.341
Solvent naphtha	5,587,370	4,471,141	1,047,095	.234
Other light oil products	3,114,531	1,388,106	111,844	.081
Total derived products	149,303,405	156,764,678	$28,879,807	$0.184
Naphthalene, crude and refined (lb.)	12,182,143	10,937,429	$135,693	$0.012
Creosote oil (gal.)	12,386,000	7,377,816		
Phenol (gal.)	57,794	66,607	910,318	.....
Pitch of tar (net tons)	54,131	1,725		
Value of all byproducts sold	.....	.....	$151,309,528‡	.....

*Includes gas wasted and used for heating retorts.
†Refined on premises to make derived products shown, 182,998,384 gal.
‡Exclusive of value of breeze production.

passed through the worst of its difficulties, and it will not be surprising if material increases in the rate of beehive coke production may be required before spring. This forecast assumes merely that the steel industry will resume operations at a rate of about 70 to 75 per cent of capacity, which is the minimum rate that can probably care for the nation's requirements, especially in view of the well-organized plans being made to avoid hard times and unemployment through unusual attention to new capital expenditures. All of such expenditures, involving both repairs and new construction, include steel as an important factor and the most pessimistic responsible forecasts for the coming year indicate that between 75 and 80 per cent of capacity operation is assured for 1930, a decrease of only about 10 and 12 per cent from the peak rates of 1928 and 1929.

Approximately 200 new byproduct coke ovens were charged for the first time during 1929. Three-quarters of these made up the three new plants which started during the year at Rockford, Ill., Philadelphia, and Pittsburgh (Davison Coke & Iron Company). Others represented increases in the number of ovens at plants previously operating. At the end of 1929 there were about 200 more ovens about to go into service or under construction. The increased output at byproduct plants was greatest in those districts where new ovens or new plants were installed.

Canadian development of coke has progressed markedly during 1929, all parts of the Dominion sharing in the increased output. It is estimated that during the year Canada produced about 2,650,000 tons of byproduct coke, or 70 per cent of its apparent consumption for the year. However, the consumption of coke in the Dominions increased markedly, so that the imports from the United States also increased slightly.

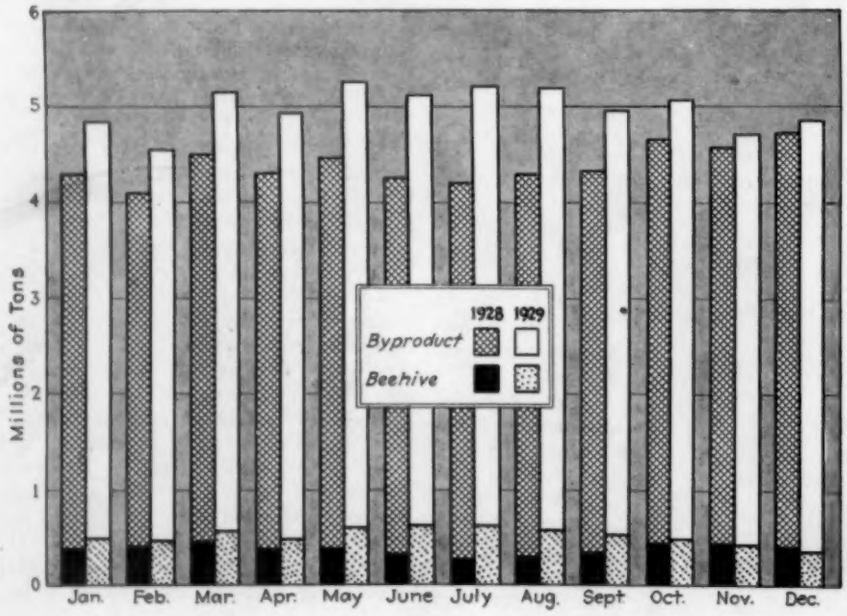
The total carbonizing capacity of byproduct plants in the United States as of Jan. 1, 1930, was approximately 85,000,000 tons of coal per year, representing a potential 100 per cent capacity output of 59,000,000 tons of byproduct coke. Actual operations during the year at all active plants of the country represented from 92 to 94 per cent of capacity output of the 87 active works. These plants were, in fact, operating practically at the maximum rate of output continuously attainable under practical conditions over considerable periods.

It is notable that with the increase in number of plants and capacity of ovens the ratio between production at oven plants connected with the iron and steel business, accounting for between 75 and 80 per cent, and those not so connected

Coke Industry in U. S., 1926-1929, and Monthly Production in 1928 and 1929

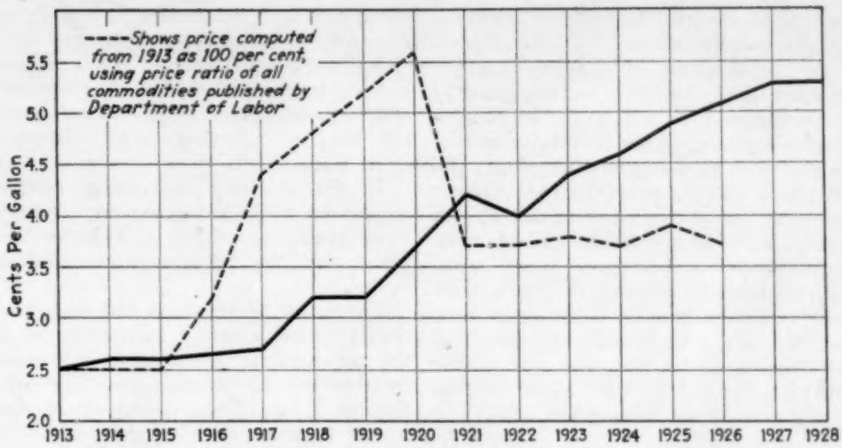
(Coke in net tons; pig-iron in gross tons)

	1926	1927	1928	1929
Byproduct coke, monthly average	3,698,000	3,657,000	4,026,000	4,480,000
Beehive coke, monthly average	1,041,000	601,000	375,000	500,000
Total coke, monthly average	4,739,000	4,258,000	4,401,000	4,980,000
Total coke production	56,968,000	51,096,000	52,812,000	59,800,000
Total pig-iron production	39,072,000	36,328,000	37,836,000	42,500,000



has remained almost constant for several years past. This is rather surprising in view of the relationship which has rapidly been developing with respect to byproduct-oven gas. The quantities of this gas used for distribution through public-utility city-gas systems has increased with extreme rapidity during the past few years. Much of this increase has, to be sure, been made by the building or enlargement of plants owned or operated by utility companies themselves, but a larger part of the increase has come about through the marketing by non-utility concerns of surplus gas to those companies which distribute gas in city systems.

CONFRONTING the coke and byproduct industry, the real problem at the end of 1929 appears to be that of prompt disposal of coke stocks, which have been accumulating at plants of both classes almost continuously since March. At the close of 1929 the estimated stock of byproduct coke on hand at producers' plants was approximately 2,200,000 tons, an amount substantially greater than that held by the producers at any time previous, so far as is known. However, the situation may not be as serious as might at first appear, because the ratio of the stocks on hand to the present rate of consumption of coke is not as much greater than formerly as are the tonnages themselves. This is in part due to the increasing consumption of coke in the metallurgical industries, but in substantial measure also to the steadily increasing market for coke as a household fuel.


----Shows price computed from 1913 as 100 per cent, using price ratio of all commodities published by Department of Labor
Cents Per Gallon
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928

Average Prices Received for Tar by Coke-Oven Operators from 1913 to 1928
Data from U. S. Bureau of Mines.

Coal Tar

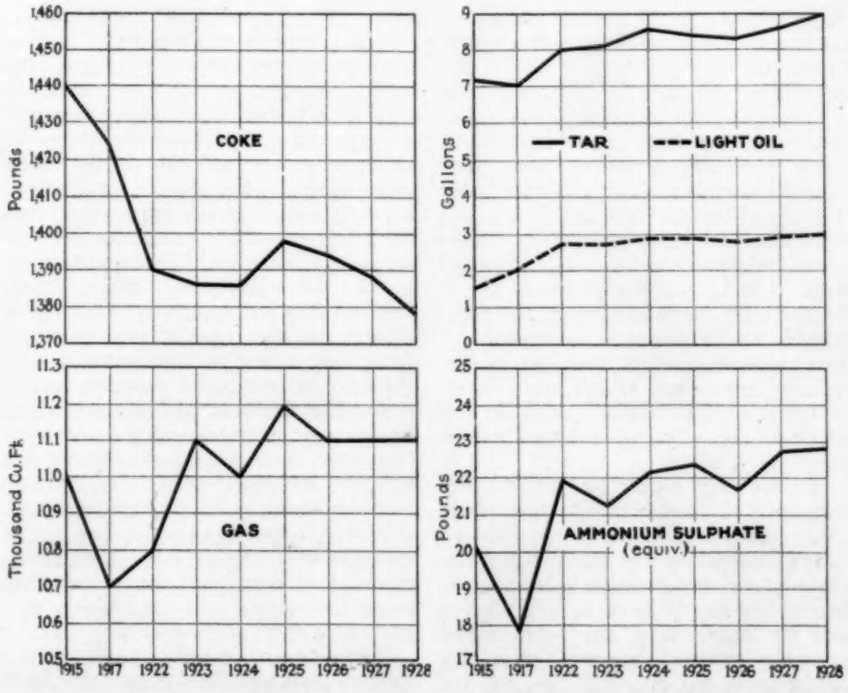
BY S. R. CHURCH
Consulting Chemist, New York,

COKE-OVEN TAR production in 1929 reached a new high record, amounting to probably a little over 700,000,000 gallons, about four times the production of 1913. The quantity of tar produced on vertical and horizontal gas retorts and in water-gas sets remains about the same, showing perhaps a slight decrease, with a total of not over 150,000,000 gallons. Of course, the increase in coke-oven tar production of some 70,000,000 gallons over 1928 is principally due to activity in the production of blast-furnace coke, but it also reflects the increasing use of the coke oven as a unit for production of manufactured gas.

Excepting the phenol group, the demand for tar products has not increased in proportion to the increased production in crude tar. Consequently the price realized by tar producers probably will show some decline. The price trend of crude tar as reported by the Bureau of Mines (Coke and Byproducts Table, 1928) is shown in the graph above, where, by way of comparison, the prices are given that would have been realized if tar had followed the price ratio of all commodities from 1913 to date, according to the figures of the U. S. Department of Labor.

ONE of the important developments in the past two years was the installation at a number of coke-oven plants of a new type of tar still which is internally heated by the coke-oven gas, for the direct production of creosote oil and hard pitch.

The principal products of the tar distillers—pitch, road tar and creosote—have remained about the same in volume and in price, excepting for somewhat lower prices for creosote during the latter part of the year. The quantity of creosote oil produced in the United States in 1928, according to the U. S. Tariff Commission (Census of Coal Tar Dyes and Chemicals), was 134,000,000 gallons, but private estimates by well-informed persons in the industry indicate that 115,000,000 gallons would be



Average Yield of Products per Net Ton of Coal Charged in Byproduct Ovens of United States, 1915 to 1928
Figures from U. S. Bureau of Mines

nearer the mark. Production for 1929 may somewhat exceed the latter figure. The consumption of creosote has remained about the same, and the quantity imported in 1929 will probably show a slight decrease. It seems inevitable that importation of creosote will decline, and that each year the proportion of domestic creosote consumed (now about 60 per cent) will increase. The use of creosoted wood is becoming more widespread, but its increased new uses, such as for factory lumber, highway bridges, and the like are offset by decreased replacements of railway ties, due to the benefits derived by the railroads from using treated ties during the past 15 to 20 years.

Use of road tar continues to show a moderate advance from year to year in spite of the fact that the disparity in price between road tars and asphaltic road products becomes greater. The tar companies have shown considerable ingenuity in devising new methods for construction of tarred roadways. One of these developments, for which remarkably good results are claimed, is a very low-cost re-surfacing of non-arterial roads using only local road metals.

There has been no change in the demand for pitch excepting for a gratifying increase in the use of coal tar base coatings and enamels for the protection of underground pipe lines. Hundreds of miles of pipe lines for carrying oil and natural gas are receiving a protective coating. These coatings range from plain bituminous material to combinations of bituminous material and fabrics. It seems to be generally conceded that tar coatings when properly applied have no superior for protection against corrosion below ground.

Naphthalene, probably the most beautiful in appearance of the coal-tar products, remains about the most unattractive from the standpoint of profits, as it continues to sell at prices which must be very close to cost of production. Anthracene, to the American tar distiller, is fast becoming only a memory.

EXPANSION of the phenolic resin industry accounts for the most important increase in the demand for tar products. Some of the new uses for resins and plastics are discussed in another article in this issue. Suffice to say here that the consumption of phenol in 1929 will exceed 25,000,000 lb., and the demand in 1930 probably will be for double that amount. The production of natural phenol cannot be very much increased, but the two largest producers of synthetic phenol have at least doubled their capacity. At one time during the year a considerable quantity of phenol was imported.

Cresylic acid has also been taken in larger volume than ever before, and in addition to the usual importation of duty-free crudes quite a large quantity of dutiable acid was brought in during the year. In spite of increased demand there has been practically no change in the price of either phenol or cresols.

Tar acids and tar acid oils are continuing to be used in slightly increased quantity for making disinfectants. Some tar acid oil is also being imported from Canada.

In the specialty department certain grades of pitch are going into rubber compounds, and there is a better demand for the paracoumarone indene resins.

The water white group, although produced almost entirely independently of the tar distillers, are usually mentioned in a review of tar products. The production of benzol has, of course, reached a new high level during the year 1929, since it goes hand in hand with tar and byproduct coke. It may be that some day the use of benzol as a raw material for phenol will be its most important outlet, but for some time to come the principal use will be as motor fuel and apparently motor fuel distributors here and abroad will take all they can get. The production of benzol in 1929 probably exceeded 135,000,000 gallons, with a corresponding use in toluol and solvent.

It should be noted that about one-third of the coke-oven tar produced in the country is still being burned by the producers, and in addition to this, 50,000,000 gallons or thereabouts of water gas tar is burned.

It is therefore apparent that there is more than enough tar available to meet all demands, and it is interesting to note that the only coal-tar product whose use is likely to increase to an important extent in the near future—phenol—is more largely derived from benzol than from tar.

■

Industrial Gas

Subject to New Factors

BY R. S. McBRIDE
Assistant Editor, Chem. & Met.

CITY-GAS COMPANIES make up one of the great groups of our chemical-engineering process industries. But they also supply one of the most important fuels used by all groups of the process industries, and also numerous important coal byproducts. These two considerations show why there is already so large a community of interest between the gas companies and other chemical-engineering enterprises. Certain new trends emphasize these points and demonstrate a still further basis for interlocking: the trend toward the development of supplies of both natural-gasoline and petroleum-refinery byproducts which are suitable to become important elements in the public-utility city-gas supply of the country.

Gas for city supply by public-utility companies is commonly spoken of as either manufactured gas or natural gas. This classification was significant a few years ago, but radical changes in sources of supply have been going on and no longer does any such simple grouping suffice. One must now take into account not only the coal, oil, and water gas made by the public utilities themselves, but also purchased coke-oven gas, purchased natural gas, and new types of light hydro-carbon liquids which are being used either alone or as enrichers. In some districts all of these sources are now significant factors, and may from time to time form essential parts of a mixed city supply. With the development of new sources of gas by progressive companies in the petroleum industries as well as by the extension of the coke-oven business not in the hands of public-utilities, there has been a decided trend toward the purchase of gas by the utility companies. During 1928, of the total utility gas sales, about 40 per cent was manufactured by utility companies, about 10 per cent was purchased from coke-oven concerns not in the utility business, and approximately 50 per cent was natural gas. During that year there was also available, but not used for public-utility supply, gaseous fuel equal in heating value to considerably more than the total output of manufactured gas sold by utility companies, including both that which they made themselves and that which they purchased from coke works.

Surprisingly enough, much of this gaseous energy supply was available within the area in which most of the manufactured gas business of the country is concentrated, namely, the Northeast.

Energy Supply of the United States and Amount Represented by Gas Industry

	Total U. S. Production — Quantity (Millions) 1927		1928	Total U. S. Production — B.t.u. (Trillions) 1927	1928	Total U. S. Production — Coal Equivalent (Million Tons) 1927	1928	To Gas Industry — Quantity (Millions) 1927		1928	To Gas Industry — Coal Equivalent (Million Tons) 1927	1928
Water power	29,900	Kw.-Hr.	34,800	1,687	1,960	67	78	....		....	....	....
Bituminous	501	tons	510	13,565	13,118	518	501	9.4	tons	9.7	9.4	9.7
Anthracite	72	tons	67	2,179	2,048	72	67	0.3	tons	0.4	0.3	0.4
Total coal	590	tons	568	15,744	15,166	590	568	9.7	tons	10.1	9.7	10.1
Petroleum (domestic)	901	bbls.	901	5,407	5,410	216	216	23.5	bbls.	23.0	5.6	5.5
Petroleum (import)	58	bbls.	80	350	480	14	20	...		...	....	....
Natural gasoline	39	bbls.	43	183	220	7	8	...		...	....	....
Total oil	998	bbls.	1,024	5,940	6,110	237	244	...		...	....	....
Natural gas	1,445	M. cu.ft.	1,568	1,445	1,568	58	63	296	M. cu.Ft.	321	11.8	12.8
Wood	...		.....	1,250	1,250	50	50	...		...	....	....
Total Primary	...		...	26,066	26,054	1,002	1,003	...		...	27.1	28.4
Coke oven gas purchased	...		...	....	....	....	....	91	M. cu.ft.	97	2.0	2.0
Coke	...		...	....	....	....	....	4.6	tons	4.2	4.5	4.1
Grand total	.....		.....	.....	.....	.....	.....	...		...	33.6	34.5

Still more surprisingly, a very large part of this available gaseous energy was wasted and practically all the rest was utilized to replace other low-grade fuel, so that it was worth to its user at best, from only one-third to one-fifth as much as it should have sold for as a part of the public-utility gas supply of the country.

Although it is not possible to estimate with any great accuracy how much natural gas and how much of these other natural-gas and petroleum-refinery by-products can be recovered in the United States and made available for distribution, it is absolutely demonstrable, as will appear below, that the present use of these products is far from complete, and that the petroleum and natural-gas business can make huge sums by diverting the present inefficiently used or waste gas supplies into useful public-utility channels.

UNTIL the last year or so, fuel engineers have talked glibly about the day when manufactured gas would have to replace the waning supplies of natural gas. Now these engineers are beginning to realize that the United States has an unbelievably large reserve of natural gas still available. And it is becoming evident that even in the territory which has been or may be supplied from West Virginia, southern Ohio, and southwestern Pennsylvania, there is no prospect of an early abandonment of natural-gas systems. About 400 billion cu-ft. of natural gas was produced and sold for public-utility city supply in 1928. But even this stupendous total sale represented only about a quarter of the total marketed production of natural gas, the balance of which was used, much of it very inefficiently and uneconomically, in field operations, at petroleum refineries, in the manufacture of carbon black, and for industrial heating not furnished through public-utility systems. In 1929 there was a very large percentage increase in public-utility gas sales. The send-out of natural gas by concerns formerly supplying manufactured gas accounted for some of this. One need only cite the fact that now San Francisco, Denver, Memphis, Birmingham, Atlanta, and a very large number of other smaller communities formerly served with manufactured gas now are being supplied almost exclusively with natural-gas.

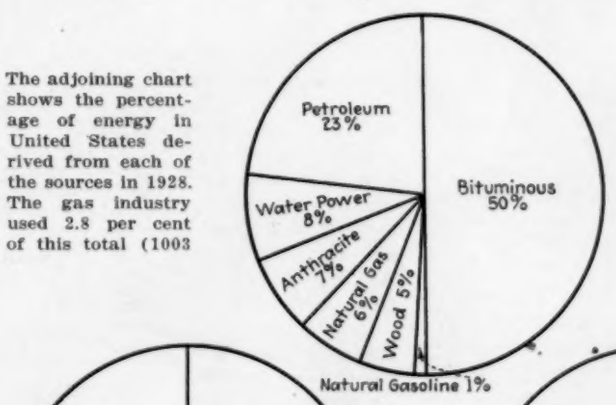
And further extension of this marketing of natural-gas is undoubtedly going to continue, for government investigations confirm the estimates of corporation geologists, that there is splendid promise for long-time service and much further extension of the field developments, which have been going on in all the area from Louisiana and Texas northward, reaching even the Canadian border and somewhat beyond. It is evident that the reserves in this area are many times greater than were estimated as the total reserve of the United States even so recently as five or ten years ago. It is probably not too much of a generalization to say that natural gas is going to replace substantially all manufactured-gas supply in the area west of the Mississippi and south of the Ohio River. If that result comes to pass, then manufactured gas operations would be restricted to the territory east of Pittsburgh and Buffalo and north of the Potomac River, a territory which certainly would not account for more than 30 or 40 per cent of that previously supplied with manufactured gas.

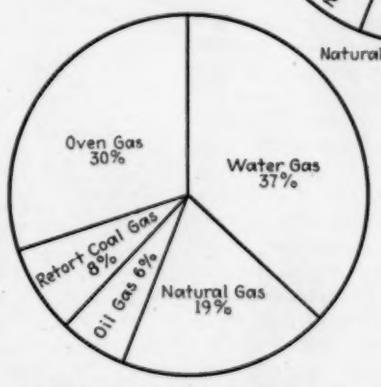
EVEN in this Northeastern territory, prominence of manufactured gas as a source of city supply is threatened by two major and several minor products of the natural-gas and petroleum industries. The refining of natural gasoline recovered from natural gas makes available a very large volume daily of those lighter hydro-carbons, essentially propane and butane, which are too highly volatile to form a satisfactory constituent of motor gasoline and are yet too heavy to be returned to the natural gas in full for transmission through pipe lines long distances for city supply. It is difficult to determine with any

Power Sources and the Part Played by Gas in the United States

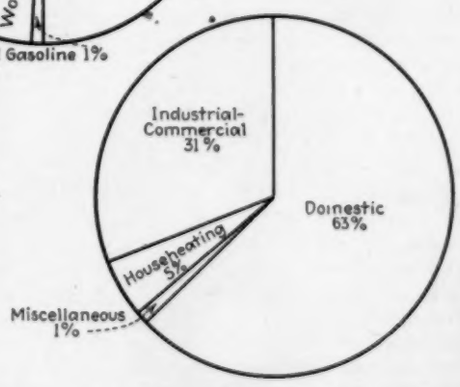
The adjoining chart shows the percentage of energy in United States derived from each of the sources in 1928. The gas industry used 2.8 per cent of this total (1003 million B.t.u.), and represented the following percentages within each group:

Bituminous ... 2.0
Petroleum 2.6
Anthracite 0.6
Natural Gas ..20.0
Others .....None





Gas sold during 1929 by public utility concerns primarily in "manufactured-gas" business.



Distribution of sales in 1929 by "manufactured-gas" companies.

(Two lower graphs based on preliminary estimates of American Gas Association)

accuracy just how much of these constituents is at present recovered at all, and still more difficult to determine how much more could be recovered if good prospective markets were offered. It is evident, however, that in the natural gas as it comes from the earth, there is enough propane and butane to be about equivalent in heating value to 40 per cent of the entire production of natural gas, or approximately 600 billion cu.ft.—half again the present consumption of natural gas through public-utility systems. Even that immediately recovered and recoverable, probably with a profit, amounts to enough energy supply to represent something between 15 and 25 per cent of the present manufactured-gas send-out of public-utility works.

PETROLEUM refineries are another potential source of city-gas supply that is as yet practically untouched, in fact almost unrecognized. These refineries produce and utilize merely for heating operations in their own plants the equivalent of 80 trillion B.t.u. per year of gas which can more or less readily be adapted to city supply. Thus here is another source equal to fully 40 per cent of the present heat production of the public-utility manufactured-gas works of the country. This gaseous fuel is, to be sure, at present used by petroleum refineries, where it is probably supplanting other hydro-carbon fuels at a rate that makes it worth to the refiner about 15 cents per million B.t.u. Since for city-gas supply they can supplant in large measure manufactured gas, that can almost never be made by the utility companies themselves at a cost of less than 75 cents per million B.t.u., their potential value is five times that as now used. This leaves a substantial margin of profit for those petroleum refiners who have the enterprise to undertake the adaptation of these refining-still gases to city supply purposes. If the petroleum industry should realize only a fourth of the estimated margin between the present and prospective value, namely 15 cents per million B.t.u., their profit would be $12,000,000 a year, which even so plutocratic an industry can hardly afford to ignore. And because this profitable basis could and would, according to local conditions, encourage production of cracking-still vent gas, it is not a wild stretch of the imagination which leads to the estimate that this energy could equal fully half, and possibly all, of the heat now furnished in gas manufactured in public-utility works.

THERE is still another source of city-gas supply which is not fully utilized. This is the coke-oven gas used at present for oven heating or sold or used in affiliated and nearby metallurgical works. In many cases these represent a heating service that could be done equally well by other gas which could be made from small-size coke in the modern types of producer at a low cost. Not all heating operations could economically make this substitution, but there are certainly cases in sufficient number to double the present supply of oven gas from coke works which are not public-utility owned. Thus, instead of equalling about 25 per cent of the utility manufactured gas, this oven-gas supply could readily equal 50 per cent and might represent even a larger per cent of the utility energy supply made from coal. Here again a careful appraisal of the relative cost per million B.t.u. of various gas supplies is essential to determine the future course.

At present only about one-fifth of the gross production of coke-oven gas is used either for public-utility or analogous industrial purposes, about two-fifths for boiler and metallurgical furnace firing, and the remainder by the producers in coke-oven firing. If both of the latter groups, which are eligible for consideration, were diverted into utility supply, the heat so furnished would equal about twice the total heat now furnished from all classes of public-utility owned works.

WHILE THEORETICAL generalizations as to possibilities of substitution are easy enough, it is quite another thing to carry them out with profit to all concerned. The real measure of success in any such change is going to be whether for a considerable period the gas users get their energy supply at a lower cost per million B.t.u. delivered to them. But not only must the gas customers be benefited: there must also be advantage to the supplier of the new source of gas and at least no disadvantage to the respective public-utility company.

Fortunately, it appears that all three interested groups can be benefited by a very extended substitution if real co-operation can be had. Much of the unused or inefficiently used gas supply which has been discussed is now being applied where it is really worth from nothing to 20 cents per million B.t.u. As stated before, there are few public-utility plants of any type where the gas ready for city supply can be put into the holder at less than 75 cents per million B.t.u. if one includes the capital charges required for the producing plant. And in many cases gas at the public-utility works is now costing them from $1 to $1.50 per million B.t.u., offering an even wider margin of potential advantage.

Three most promising combinations of circumstances are here again enumerated as deserving immediate attention and as impendingly important factors in the supplanting or supplementing of the existing manufactured-gas supply:

1. The further use for city service of coke-oven gas now uneconomically conscripted for steel plants and oven firing.

2. Petroleum-refinery vent gases, of which 30 to 40 trillion B.t.u. a year are available, could supply, by established technical methods, at least 10 per cent of the present heat requirement furnished from public-utility gas works within the next 18 months or two years, financial advantage for both petroleum refiners and the city-gas companies.

3. Propane and butane recovered and wasted to the extent of three quarters of a million gallons a day, could be delivered even in relatively remote parts of the United States at a price not exceeding 75 cents per million B.t.u. with very substantial profit to the producing company. This quantity of propane and butane, equivalent to about one-eighth of the present thermal send-out from utility-owned gas works, would be merely a beginning, for creditable estimates indicate that from four to ten times this amount may ultimately become available.

INCENTIVE for quick action in these matters is furnished by the fact, on one hand, that the first concerns in the field are going to be able to skim the cream of the patronage by making contracts in the most favorable territory, and on the other hand, that the utility company through using these additional sources of gas supply, will attain cheaper production costs. This, in turn, permits the establishment of more favorable rate schedules for both household and industrial users of city gas.

There is a second, most compelling, motive to urge the early action by utility companies. If the utilities do

Available Gaseous Fuels in U. S. and Public Utility Systems in 1928

Source of Gaseous Fuels	U.S. Totals		In Public Utility Systems		
	Billion cu.ft.	Trillion B.t.u.	Billion cu.ft.	Trillion B.t.u.	Per cent of Total
Natural—total marketed	**1568**	**1568**	**513**	**513**	**33**
Domestic	321	321	321	321	100
Industrial	383	383	192	192	50
Petroleum refinery	115	115	0	0	0
Carbon black	175	175	0	0	0
Field operations	574	574	0	0	0
Coke Oven—total	**776**	**420**	**125**	**68**	**16.1**
City distribution	125	68	125	68	100
Industrial	25	14	0	0	0
Boiler and steel furnace	305	164	0	0	0
Oven heating and wasted	321	174	0	0	0
Gas Works—total	**335**	**187**	**335**	**187**	**100**
Coal gas (including small ovens)	62	35	62	35	100
Oil gas	33	18	33	18	100
Water gas	240	134	240	134	100
Petroleum and Natural-gas byproducts—total	**297**	**656**	**0**	**0**	**0**
Refinery gas	77	81	0	0	0
Propane—butane	220	575	0	0	0
Grand total	**2976**	**2831**	**973**	**768**	**33** (Vol.) **27** (B.t.u.)

not take over these sources of gaseous energy and work them into their industry effectively, then the producers of the surplus oven gas, propane and butane, and refinery-still gas are going to look elsewhere for customers. They will discover that hundreds of industrial establishments in the country can use these gases with great advantage if offered at less than $1 per million B.t.u. Though these industrial users would perhaps a little rather get their supply from public-utility companies, they do not propose to pay extravagantly for being supplied from a city main. If the utility company does not exploit the low-cost raw materials to supply them with heat at the minimum practicable price, these concerns are going directly to the primary source of supply themselves, and will make contracts with the oven operators, the natural-gasoline producers, and the petroleum refineries that are appropriately located.

WHILE direct dealing between original producers and industrial consumers seems to have a considerable mutual advantage, it is doubtful that it is as great as appears at first sight Thus, it is easier for the original producer to have a limited number of large outlets in the form of utility companies with which it can make long-time contracts and to which it can supply under most convenient conditions. Then the users do find a very real convenience in taking their gas from the city mains; they can afford to pay a definite margin above what they would pay for heat from sources not offering the advantages of the utility concern. It is evident, however, that if the utility company is going to serve as an intermediary purveyor of heat it must operate with the most efficient choice of raw material and on a basis of a narrow margin of profit corresponding to the degree of service which it actually renders.

If a very large number of contracts were entered into between natural-gasoline companies and industrial-gas users for propane and butane, for example, this might readily become a serious obstacle in the way of a stabilized public-utility gas supply in that community. As all-season users of gas, these industrial groups create a base load of high-capacity-load factor which is most advantageous to the utility company. Although securing gas at the lowest rate, they are often the most profitable customers of the company, if, indeed, they do not support, by the year-round profit which they afford, a large part of the small business with its highly seasonal load curves. It is to be hoped, therefore, as a general economic advantage to all of a community, that the distribution of these special gases be incorporated in the public-utility gas business. In the long run everyone will be benefited by such a retention, including the sorely tried stockholders of public-utility enterprises.

City Gas

Trends

CITY-GAS SALES in 1929 exceeded any previous record in both the natural-gas and the manufactured-gas divisions of the industry. Estimates by American Gas Association indicate 1,890 billion cu.ft. of natural gas so distributed and 535 billion cu.ft. of gas supplied by the "manufactured gas" division of the industry, including some natural gas purchased by this class of companies. Tables and graphs on page 37 illustrate the relationship of the gas industry to the energy supply of the United States as a whole, based on 1928 statistics, the latest available for all fuels. The gas industry would be more conspicuous if it were possible to make the comparison on the 1929 data, where increases over 1928 were 20.5 per cent in the natural-gas division and 9.2 per cent in the manufactured gas.

The growth in city-gas send-out was reflected in an increase of 3 per cent in the number of customers supplied by the manufactured gas companies to a total of 12,200,000. The gross revenues in 1929 increased by 4 per cent to an aggregate of $548,000,000. Miscellaneous sales to the industry declined, according to A.G.A. statistics, apparently because of more accurate classification of send-out. All of the classified groups of sales increased markedly during 1929. Sales for domestic uses were 4.4 per cent greater, for industrial and commercial purposes nearly 12 per cent greater, and for house heating, though still only 5 per cent of the total, more than 50 per cent greater than in 1928.

Production of gas by public-utility companies themselves actually declined by 4 per cent in 1929, largely because of the abandonment of retort coal gas in small works and the replacement of water gas, especially in larger works. Between 9 and 10 per cent decline occurred in the production of both water gas and retort coal gas during the year. Coke-oven gas produced by utility companies themselves increased in volume by 28 per cent and exceeded in total volume both retort coal-gas and oil-gas production for the first time. Purchases of coke-oven gas from non-utility producers increased by 29.5 per cent and became second in importance to water gas as a source of supply. During the year, 30 per cent of the total send-out was coke-oven gas, measured by volume, and 20 per cent more was natural gas purchased by these companies, either for mixing with manufactured gas or for supplanting it altogether.

Measured in terms of the heat supplied a still more striking situation is disclosed by the returns for 1929. They show that 30 per cent of the so-called "manufactured gas" send-out was actually natural gas and that 25 per cent more came from coke ovens. Thus only 45 per cent of the total marketed send-out came from that class of plants commonly thought of as belonging in the manufactured-gas business.

Despite the amazing trend thus disclosed, a still further development is expected in 1930, because many of the areas using oven gas or natural gas at the end of the year were so supplied during only the last few months. There is every indication that in 1930 less than 40 per cent of the so-called manufactured gas business will be in coal-gas, water-gas, or oil-gas; it would not be surprising, in fact, if barely 30 per cent of the gas were of this character by 1933 or 1934.

The tendency to replace the older systems of gas making is still more strikingly shown if one puts together all of the divisions of the gas industry. In that event one has the following relationship in percentage of volume and heat supplied by the public-utility gas systems of the country:

	Volume Per Cent	Heat Sold Per Cent
Natural Gas	81	88
Coke-oven Gas	7	4
Coal, Oil, and Water Gas	12	8

The large influence of this development is discussed in the economic interpretation of city-gas supply and the discussion of the coke-oven and byproduct industries, which are separately reported on preceding pages of this issue.

Plant Construction Gains 37 Per Cent in 1929

The following tabulation compiled from the construction statistics of *Engineering News-Records* shows an increase of $32,000,000, or 37.6 per cent more than 1928, in the value of industrial building contracts awarded in the process industries.

Number and Value of Industrial Building Contracts in the Process Industries 1928-1929, $40,000 and over, U. S. A. (000 omitted)

	1929		1928	
	No.	Value	No.	Value
Lime, cement	6	$2,304	6	$2,304
Clay and brick	25	3,828	15	2,939
Glass	12	9,652	9	7,506
Paint and varnish	9	533	16	1,275
Petroleum products	46	58,293	38	6,954
Coke	2	165	4	459
Manufactured gas	12	2,260	12	9,765
Plastics			3	1,120
Explosives	1	44	1	300
Fertilizers	2	330	1	100
Soap	6	1,870	2	140
Heavy chemicals	54	8,262	43	7,477
Fine chemicals	5	649	8	1,580
Wood chemicals				
Leather goods	9	1,186	11	1,481
Rubber products	30	9,383	20	3,473
Paper and pulp	25	12,051	26	8,761
Rayon	4	726	5	20,240
Oils (vegetable, animal)	2	44	1	56
Sugar	4	308	1	40
Other proc. indus.	9	2,392	20	6,661
	263	114,280	242	82,631
Per cent increase over 1928	8.7	37.6	...	.....

Non-Metallics

Acquire Greater Stability

By PAUL M. TYLER and OLIVER BOWLES
Washington, D. C.

ONLY RECENTLY the quality of non-metallic mineral products was dominated by the caprice of nature. The chemical engineer who sought a super-refractory, an acid-resisting brick, or a polishing powder, was limited in his selection by the mineralogical character of known deposits. In the manufacture of chemicals, in the refining of metals, or in the production of fabricated articles, it is possible ordinarily to control within narrow limits the quality of the product. On the other hand, although the owner of a building-stone quarry may grade his product carefully by a process of selection, broadly speaking, he cannot substantially alter its character. Conditions beyond his control, such as a change in popular taste, may therefore prove disastrous to his business.

Factors of this sort together with the sharp rivalry between manufacturers of the same product have finally forced them to the realization that they must band together and fight jointly for their place in the sun. At the same time research has come to their aid.

Idle plants and a tendency to overproduction have been the bane of the non-metallic mineral industries. Occasionally, of course, a deposit has become exhausted, but usually the demise of an operation has resulted from collapse of the market or, too often, because no suitable market was ever found. In the last year or two, however, plants for the treatment or further advancement of non-metallic raw materials, notably gypsum, have been located adjacent to consuming centers rather than at points of production.

A further factor tending to prolong the life of individual plants is the more intelligent effort to meet falling prices by reducing costs. Again, consolidations—both horizontal and vertical combinations—show a tendency to increase, but price cutting and questionable sales practices, formerly the inevitable results of overproduction, now tend to give way to fair dealing and co-operative efforts by manufacturers to improve the quality of their goods and to explore new uses. Part of the industry is co-operating with the Federal Trade Commission on trade practices.

Abrasives—A further falling off was noted in the demand for garnet in 1929, and the same probably was true of other natural abrasives. Hoped-for extension of the use of garnet in the polishing of plate glass, replacing ordinary sand, did not materialize, and the industry lost ground to artificially prepared products. Whereas, in former years ordinary abrasives have made inroads upon the field of metal-cutting tools, tungsten carbide tools are now beginning to replace non-metallic abrasives for certain purposes.

Commodity	Consumer		Producer		Relation to imports		
	Large	Medium	Large	Small	Totally dependent	Largely dependent	Slightly dependent
Asbestos	×			×	×		
Barytes	×		×				×
China Clay	×		×			×	
Fluorspar	×		×				×
Graphite	×			×		×	
Gypsum	×		×				×
Magnesite	×		×				×
Mica	×		×				×
Talc and soapstone	×		×				×

This Chart Shows the Position of the United States as a Producer, Consumer and Importer of Nine Principal Non-Metallic Raw Materials

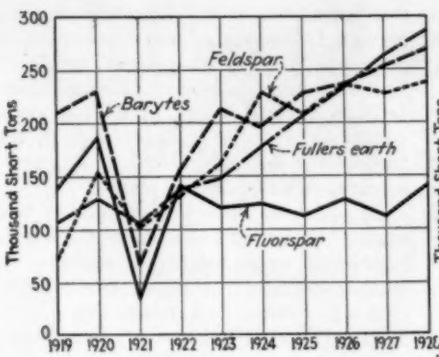
Refractories—This field is one where substitution has played an important part. Only a few years ago the output of chrome brick was scarcely 10 per cent of the output of magnesite brick, but, due to increased prices for the latter, the number of chrome brick produced in the United States at the present time probably exceeds that of magnesite brick. Actually there has been no falling off in the sales of magnesite brick, but the industry has not been able to share in the much increased demand for high-duty refractories. The situation might have been more serious were it not for the fact that unburned magnesite brick (using a chemical binder) has been placed on the market at prices to compete with chrome brick.

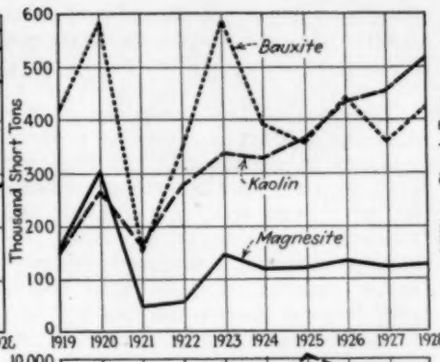
There are several newcomers in the list of refractories, most of them being synthetic combinations of clays and other natural materials. Of special interest, however, is the growing use of natural aluminum silicates such as sillimanite and kyanite. The value of artificially prepared mullite in porcelain compositions for spark plugs was announced by the Bureau of Standards soon after the World War, but it was found that the synthetic aluminum silicates were too costly. Extensive deposits of natural aluminum silicates have been found in California, Nevada, North Carolina, Virginia, and elsewhere in the United States, and in India. Sillimanite, andalusite, kyanite, and also dumortierite, all change to mullite when heated. A glass for laboratory ware, spark plugs, and sundry high-duty refractory items of the mullite type are now being employed fairly extensively. Mullite blocks in glass tank furnaces have outlasted all of the usual linings, and mullite is recommended for glass pots, enamel furnaces, electric furnaces, muffles, checker-work, and in various other high-temperature services where rigidity and non-shrinking, non-spalling characteristics are particularly required. Recently, saggers containing kyanite showed under test a much longer life than those ordinarily used in firing electrical porcelain.

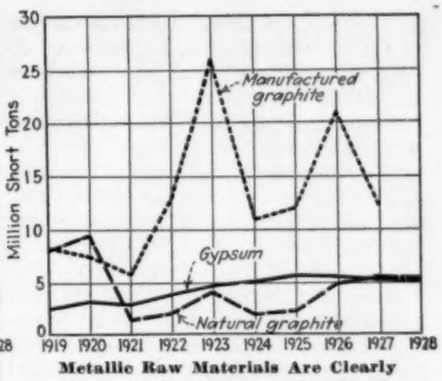
As to manufacturing trends, mention may be made of the continued installation of tunnel kilns coupled with the dry-press process. A continued effort is being made to produce refractories true to size, and the tendency is toward higher pressures in dry-press operation and harder firing. Higher percentages of flint clay are being used. The use of natural gas for kiln firing is extending. Several plants in Kentucky and southern Ohio have already shifted to natural gas on periodic kilns. Gas has been brought into St. Louis and is being used for tunnel kiln firing.

Heat Insulation — The variety of mineral products employed for heat insulating purposes is legion, and it is difficult to determine which are gaining and which are losing relatively in popular favor. One trend, however, is clearly in evidence, and that is the movement toward utilizing a greater variety of raw materials in conjunction with one another. Thus, the Johns-Manville Company, long established manufacturers of asbestos insulating materials, has assumed control of the plant at Lompoc, Calif., of the Celite Products Company, the largest producer of diatomite in the United States, and has also purchased the factory at Alexandria, Ind., of the Banner Rock Products Company, producer of mineral wool from self-fluxing limestone. Expanding sales, chiefly for electrical refrigerators and building board, are reported by the producers of zonolite, calcined vermiculite (a variety of mica).

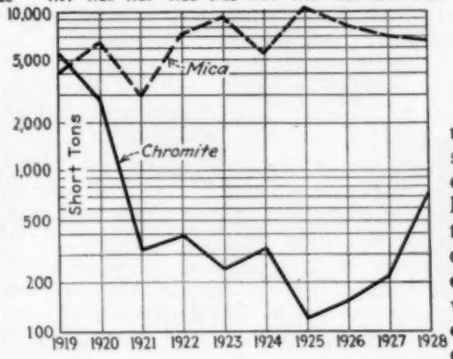
The increasing use of molded brake-band linings instead of woven bands in automobiles may have a far-reaching effect on the future of the asbestos industry. Hitherto, the weaving of brake-band linings has consumed by far the bulk of the longer, or spinning fiber, but ordinary good grades of non-spinning fibers are suitable for making molded bands. Canada, which formerly held a commanding position in the







Trends of Domestic Production of 12 of the More Important Non-Metallic Raw Materials Are Clearly Shown in the Accompanying Charts



supply of asbestos, has been losing its grip on the world situation. Africa is becoming a more and more dominant factor; the handicap of difficult transportation from the extensive deposits in Rhodesia and the Union of South Africa is being overcome by the building of railways and aerial tramways.

Even in the supply of short milling fibers such as are used in asbestos wall board and paper and in pipe coverings, Canadian supremacy is being challenged by the prospects of substitution of amphibole asbestos from the Middle Atlantic and Southern states. The amphibole material is more brittle than the chrysotile variety and is therefore somewhat less desirable for many purposes, but it is much cheaper, delivered at Pennsylvania consuming plants.

Building Materials—To the long list of competing building materials was added last year what may be called "synthetic slate granules," made by precipitating insoluble colors on crushed gravel or burnt clay. Thus the bright colors now so popular in roofing materials, but so difficult to obtain in nature, are obtained by synthetic processes. A great increase is noted in the use of ground mica for surfacing asphalt shingles and the relatively new industry producing plaster wall finishes last year accounted for at least 1,500 tons, and a far greater outlet may be provided for a cheap grade of mica as a lubricant in various plasters that are laid with a trowel. These new demands, together with increases in other lines, have called for increased production. Until recently, enough scrap was made in the sheet-mica trimming sheds to satisfy the demand for ground mica, but additional material is now obtained from mine dumps, from mica schist mines, and from clay-washing plants. One clay plant in the South recovers 10 tons of mica per day as a byproduct.

A plant producing "Heraklith" is soon to be built by the Northwest Magnesite Company, in the State of Washington. Similar plants are operating in Germany and Australia, but this appears to be the first important step toward introducing magnesite lumber to the American market. It will be interesting to observe whether magnesite, after losing ground to white portland cement for exterior use, will compete successfully with gypsum for interior use.

Few industries have succeeded in developing so diversified a list of products from one raw material as has been developed by the gypsum industry. Among the newer products are various forms of acoustical plastics, sound- and heat-insulating materials, porous lightweight blocks, gypsum lath, partition tile, and sundry forms of blocks and panels. Even with these additional outlets, the recession in building construction during 1929 no doubt further intensified the condition of oversupply and retarded production. A number of powerful companies are operating in this field and, spurred by the necessity for reducing costs, they have improved the technique of operations.

Much progress has been made in the use of rotary kilns in place of the old style kettles. In the past the rotary-calcined product has often exhibited a lack of uniformity either in setting time or plasticity. In the "super-calcining" process now employed, however, the material discharges directly, without cooling, into a tube mill before calcination is quite complete. It is claimed that the heat evolved in tube-mill grinding completes the calcining process and at the same time any over-burned material is rehydrated, giving a uniform product of correct chemical and physical properties. Also tube milling greatly increases the plasticity.

The utilization of byproduct gypsum at chemical plants is becoming of greater importance. Large tonnages are formed particularly at phosphoric acid and baking powder plants. Several factories are now in operation manufacturing gypsum products from this byproduct material. Such plants are handicapped to some extent because the supply of gypsum at individual chemical plants is more limited than supplies from gypsum mines and the factories cannot reap the benefits of large-scale operation. On the other hand, the raw material is obtained at nominal cost.

The Bureau of Mines is continuing experimental work on the use of anhydrite as a cement retarder. Tests

Production and Imports of Principal Non-Metallic Raw Materials
(Not elsewhere covered in this issue)

	Production Short Tons		Imports Short Tons	
	1927	1928	1927	1928
Abrasives				
Emery	206	1,341	4,126	4,846
Garnet	6,939	6,617	.....	($115)
Pumice	53,298	57,430	($124,074)	($159,430)
Tripoli and Rottenstone	26,099	30,299	($15,403)	($21,883)
Asbestos	2,981	2,239	223,693	230,594
Asphalt				
Natural and related bitumens	839,040	799,071	161,924	125,060
From petroleum (total)	3,951,450	4,005,529	.....	.....
Barytes	254,265	269,544	70,274	61,765
Bauxite	359,453	420,477	399,370	392,124
Chromite	225	739	249,043	242,582
Clays (All)	3,849,176	3,975,000	394,500	370,379
Kaolin	454,245	512,000	339,014	307,304
Cryolite (natural)	None	None	5,672	7,735
Feldspar	226,797	236,108	30,715	31,200
Fluorspar	112,546	140,490	63,609	47,450
Fullers Earth	264,478	287,012	7,580	7,593
Graphite				
Natural (total)	5,226,995	5,236,294	17,452	17,569
Manufactured	12,257,239	Not available	.....	.....
Gypsum (crude)	5,346,888	5,102,250	828,619	1,028,816
Magnesite	121,490	127,200	60,117	63,243
Mica	7,036	6,610 (Est.)	1,729	2,052
Sand and silica				
Glass sand	2,171,693	2,000,000	10,665	43,137
Quartz	22,144	22,198	12	None
Talc and soapstone	192,316	205,926	25,194	27,049

now being conducted deal with the effects of extremely fine grinding. A new type of air analyzer has been devised by means of which very fine grained materials may be closely classified by size. The Mines Branch, Department of Mines, Ottawa, Canada, is conducting research on the utilization of anhydrite for plaster manufacture.

Barytes—The barytes industry has been expanding in response to the growing demand for barium products, and particularly for lithopone, the use of which is increasing more rapidly than that of most other white pigments. Wider use is being made of barium carbonate as an addition to clay to prevent the formation of scum on brick made by the stiff-mud process. It would seem that the United States is becoming more nearly self-sustaining in the production of barium chemicals, for imports during the first nine months of 1929 amounted to only a little more than one-half what they were during the corresponding period in 1928.

Natural Pigments—In an effort to assist the development of domestic deposits of mineral paints, Hewitt Wilson, at the Northwest Experiment Station of the U. S. Bureau of Mines at Seattle, Wash., has examined samples from various parts of the country. The technique of testing these materials is described at length in Bureau of Mines Bulletin 304, entitled "Ochers and Mineral Pigments of the Pacific Northwest." The demand for ocher and other coloring materials is increasing, not only in the paint trade but as fillers in linoleum, and as mortar colors for cement and stucco.

Feldspar—Feldspar is used principally in the form of a fine powder as a constituent of ceramic bodies. A noteworthy recent advance in feldspar grinding is the movement toward better control of composition of the finished product. Feldspar rarely occurs alone in nature; it is usually accompanied with 5 to 25 per cent of quartz and variable amounts of mica, hornblende, tourmaline, and other minerals. In order to maintain a uniform grade of shipping product, the more recently constructed grinding plants are provided with a series of bins, into each of which is sorted spar of approximately uniform composition. When the chemical composition of the contents of each bin has been determined, it is then a simple matter to prepare mixtures to meet specifications within rather narrow limits. Other improvements found in the newer mills include continuous tube mill grinding, air separation, and compressed air transportation.

The substitution of clay for feldspar in glass making may have some effect on market demands. Feldspar is added to supply alumina and potash, but clay contains a larger percentage of alumina and the requisite amount of alkali can be supplied more cheaply as soda ash.

Fluorspar — The prosperity of the fluorspar industry is dependent in large measure on metallurgical activity, for steel furnaces and foundries consume 80 to 85 per cent of the total, and aluminum metallurgy is using increasing amounts. Fluorspar is regarded as an essential in basic open hearth steel furnaces to keep the slag thin and to make clean castings. About 8 per cent of the production is used in the glass and enamel industries. The balance is used in the manufacture of artificial cryolite (used in aluminum metallurgy), hydrofluoric acid, sodium fluoride and other chemicals.

One of the most significant recent developments is the great increase in the production of high grade acid spar, 15,946 short tons in 1928 as against 3,748 in 1927. This is due to improved methods of flotation concentration worked out by the Franklin Fluorspar Company, partly in co-operation with the Mississippi Valley Experiment Station of the U. S. Bureau of Mines at Rolla, Mo. This great increase has affected imports of acid spar which in 1928 were only 3,300 tons as against 7,500 tons in 1927.

A significant change has also taken place in the uses of fluorspar. Averaging the figures for shipments of domestic fluorspar by uses for the last 6 years prior to 1928, it appears that 87 per cent was employed in metallurgy, about 8 per cent in glass and enamel, and 3.6 per cent for the manufacture of hydrofluoric acid and derivatives. In 1928 the percentages shipped for use in metallurgy dropped to 79.6, while the percentage of acid spar more than trebled, reaching 11.4. This change is due to the increased use of fluorspar in chemicals, particularly in aluminum metallurgy. Most of the acid spar is used by the Aluminum Company of America which owns the Franklin Fluorspar Company mines. It is a fortunate circumstance that the company has been able to develop a process which makes it possible to supply the needs from its own mines and mills.

Some interest has been shown in the use of fluorspar as a flux in cement manufacture, 951 short tons having been shipped to cement plants in 1928. Apparently it is used chiefly in the manufacture of special cements, and no great increase in this use is expected.

Clays—The American kaolin industry has always encountered keen competition from abroad. Foreign clays, particularly the carefully graded English clays, were strongly entrenched both in the pottery and in the paper industries, and it is difficult to induce manufacturers to change their formulas. The World War forced the use of domestic clays and American producers seized this opportunity to establish a permanent industry. Abundant supplies of high grade clays have been developed in the United States, and although competition is still keen, producing companies have found faith enough in the future to encourage them to build modern, well-equipped plants.

In order to improve the quality and assure uniformity of domestic clays, producers soon found it desirable to install washing equipment for the mechanical removal of impurities. Until relatively recently, however, these treatment processes were quite simple and purely mechanical. The use of electrolytes for controlling dispersion is one of the newer developments. In the paper industry, prior to 1925, domestic clay was being used for loading or filling, but practically no satisfactory American coating clays were available. After the Edgar Brothers Company perfected its processing methods, however, imported clays were displaced by domestic, which in 1929 comprised approximately one-half of the clay used by the paper-coating industry. Processed or bleached clays are also used for the highest grade filler work.

The production of activated earths for the purification of oils and fats was begun in 1921 by the Filtrol Company of Los Angeles, Calif. They are produced by the treatment of clay-like minerals with acids. Many of the large consumers of these acid-treated clays, notably the petroleum refiners, formerly used fullers earth or other low priced natural absorptive earths. In changing over to the use of the high priced, chemically treated material, they had to abandon their old methods of purification and adopt the contact processes of purification. Material changes had to be made in plant equipment. Percolation processes though suitable for use with cheaper absorptive media are not adapted to the use of highly activated earths. Due to the increasing importance of these new products, specific provision for them was recommended by the Finance Committee in the new tariff bill. Imported activated earths, it was shown, were sold c.i.f. American Atlantic ports at $48 per short ton as compared with $68.40 for the American product delivered at New York City.

Even in the manufacture of heavy clay products it is worth while to spend time and thought upon improving the quality of the raw material. In the case of clays used for the fabrication of building materials, considerable progress has been made during the past year in the use of electrolytes in the attempt to change the colloid matter. Cracking in the green ware has thus been reduced and greater strength has been obtained in many cases both in the green ware and in the finished product. Modern technology, it seems, will make it possible to alter a clay to many desired uses, avoiding the former necessity of seeking a new clay for each new use.

Fertilizer

Industry Maintains Status

EDITORIAL STAFF INTERPRETATION

FERTILIZER producion in 1929 was slightly under that of the preceding year. Indications from fertilizer tag sales in various states are that the decline in output was barely 1 per cent of the 1928 production; but other evidence indicates a greater decline. *Chem. & Met.* estimates that between 2 and 3 per cent smaller tonnage of fertilizer was produced and marketed in the calendar year 1929 than during the preceding twelve months.

Reduction in tonnage of fertilizer was, however, not accompanied by reduction in the consumption of nitrogen, potash, or phosphate. Apparently the decline in gross tonnage was more than offset by an increase in concentration of these three plant foods in the various fertilizers marketed, so that actually during the last year there was a greater sale and consumption of plant foods than during any preceding twelve months.

The fertilizer industry has never been accorded as much credit as it should have received for the steady progress which it has made in the marketing of more concentrated fertilizers. Despite all handicaps, both psychological and technical, there seems to have been marked progress in plant-food consumption by the agricultural interests of the country almost every year during the last decade. The few exceptions have been noted in those years when there has been a very large decline in tonnage, which declines could, of course, not be offset altogether, if at all, by increases in concentration. There has not been wide appreciation of this progress—and it is very real economic progress—largely because most observers have given attention only to the gross tonnages and have failed to calculate plant-food tonnages, since data have been difficultly available, if at all, on this feature of the business.

Large profits were not expected by the fertilizer industry during 1929; in fact, many leaders of the industry entered the year in a most pessimistic frame of mind. Fortunately, however, a considerable number of companies have been able to make profits, which, though small, were both unexpected and welcome. A few companies have been even more successful and they reported almost normal profits from their operations. In the face of the unfavorable outlook at the beginning of the year this result actually represents a very creditable finding.

It is not easy to place proper credit on all of the factors contributing to the favorable financial developments of the past year; but among the most important of all factors probably has been the emphasis which has been given to observance of the trade practice code of the industry, which had its first full year's trial under fire during the past season. Apparently the industry has at last accepted the idea that fallacious schemes of price cutting, rebating, and secret price adjustments are wrong and has taken very definite steps toward commercial operation along modern ethical lines.

Table I—Sources of Commercial Plant Food in the United States

Nitrogen—Tons of Nitrogen			
Materials	1913	1926	1928
Sulphate of ammonia	30,750	84,562	128,450
Nitrate of soda	52,700	113,770	120,000
Calcium nitrate	.....	2,293	4,000
Luena salpeter	.....	4,576	23,000
Cyanamide	5,590	20,855	32,000
Total inorganic	89,040	226,056	307,450
Per cent inorganic	42	77	85
Animal tankage	16,800	10,500	10,500
Cottonseed meal	56,000	31,500	18,000
Guano	7,680	832	1,600
Dried blood	6,270	1,375	1,375
Fish scrap	15,500	4,464	4,464
Garbage tankage	3,080	3,500	3,500
Castor pomace	1,512	1,512	1,512
Leather waste	1,696	1,696	1,696
Hair and wool waste	1,400	1,400	1,400
Hoof meal	738	738	738
Base goods	11,100	10,000	10,000
Total organic	121,776	67,517	54,785
Per cent organic	58	23	15
Grand total	210,816	293,573	362,235

Phosphoric Acid—Tons P_2O_5			
	1914	1925	1928
Superphosphate	677,500	737,280	808,000
Bone meal	34,900	13,400	13,000
Basic slag	2,800	.....	.....
Total	715,200	750,680	821,000

Potash—Tons K_2O			
	1913	1926	1928
Domestic	.....	23,366	55,000
Imported	255,957	245,700	300,000
Total	255,975	269,066	355,000

Data by H. R. Smalley, National Fertilizer Association.

Late in the year it was definitely decided to revise the code and recognize not only those rules which the Federal Trade Commission has approved but also a supplementary set of voluntary trade practices that take on almost as much force as do the compulsory regulations which have been formulated in co-operation with the government. At the close of the year the revised code in two parts is before the industry for acceptance and there is every indication that almost unanimous approval will be forthcoming. The industry took a second step, adding strength to these bettered trade methods, by the tentative adoption of a scheme of enforcement which has been put forward under the able leadership of Charles J. Brand, executive secretary of the National Fertilizer Association. This scheme probably is the most comprehensive and definite of any that has been considered by any trade group or association for insuring compliance with the proper practices fixed under the scheme of self-regulation.

Three outstanding educational efforts were made by the fertilizer industry during the past year, or reached more or less definite fruition in that period. First, there was the very effective scheme for co-ordination of educational and administration efforts of all interests which desired to promote the marketing of their fertilizers or fertilizer chemicals. By this scheme potash, phosphate, and nitrogen interests will co-ordinate their activities and co-operate with the fertilizer industry in furthering the mutual interests of all.

The second effort, in part an outgrowth of the first, has afforded very tangible benefit in the demonstration that the fertilization of pasture lands is economically worth while. It is now convincingly demonstrated that the farmer can replace expensively prepared feeds by natural pasture growth in large measure if the proper scheme of pasture fertilization is practiced. This substitution of fertilizer for feed as a raw material in dairy and stock farming offers interesting developments of large significance to several industries.

The third educational project has to do with distribution problems, particularly among the wholesale and retail dealers who handle fertilizers. The National Fertilizer Association has taken up with 60,000 such persons the problems of proper trade practices and is enlisting co-operation of all distributors and dealers in the support of honest trade practice methods. It is hoped that one result of this educational campaign will be to relieve fertilizer manufacturers of the unreasonable demands of dealers who formerly have looked upon special rebates and price adjustments as a proper part of fertilizer selling.

During the year much attention has been given to the traffic problems of the fertilizer business. At one time there appeared to be serious threat of substantial increases in freight rates, but at the close of the year the industry finds itself with a somewhat more favorable freight structure, particularly with some significant and valuable reductions in rates in the Central Freight Association territory of the Middle West. Thus this substantial element in the cost of delivered goods has been helpfully modified rather than unfavor-

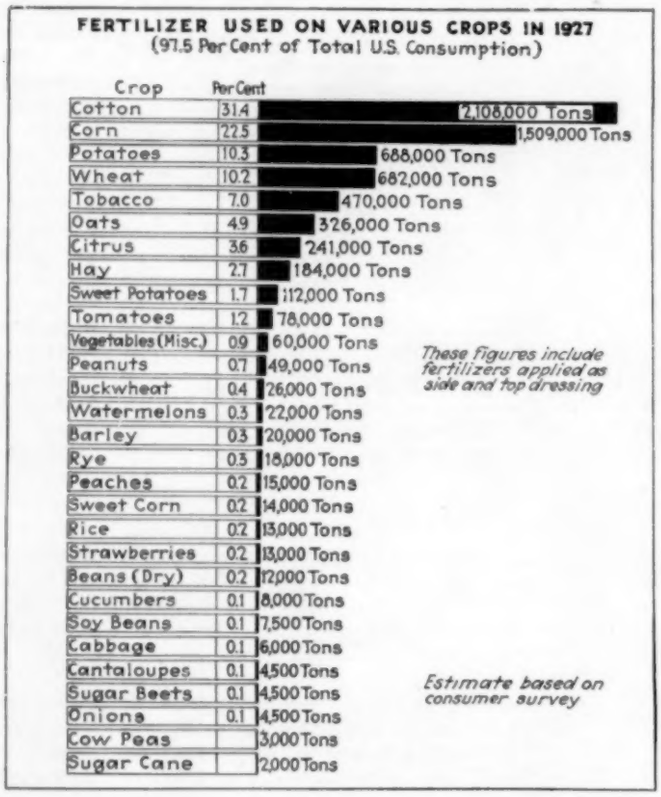
ably changed, as seemed likely earlier in the year.

American fertilizer industry as it operated during 1929 is peculiarly constituted. It includes three large companies with total sales approximating 2,000,000 tons; four additional companies, each selling between 400,000 and 500,000 tons per year; and approximately five additional concerns with annual sales averaging nearly 200,000 tons of fertilizer each. These twelve companies, with aggregate sales of between 4,500,000 and 5,000,000 tons constitute fully 60 per cent of the industry. There are perhaps a dozen more that average between 75,000 and 100,000 tons in annual sales. But hardly any one of this second dozen sells enough to represent more than 1 per cent of the industry. Following the second dozen there are more than 100 companies which actually make fertilizer (that is, who are not mere mixers) that are significant factors within the territory where they individually operate. And finally, there is a great group of several hundred concerns, mainly mere mixing-plant operators, all of which together probably make up less than ten per cent of the business.

Table II—Trend in Recent Fertilizer Sales

	Fertilizer Sales (Millions of Tons)	Percentage (Approx.) of Plant Food Contained	Tonnage of Plant Food (Millions of Tons)
1920	7.27	14.0	1.02
1921	4.86	13.0	0.63
1922	5.67	13.5	0.77
1923	6.44	14.5	0.93
1924	6.82	15.0	1.02
1925	7.33	15.5	1.14
1926	7.33	16.0	1.17
1927	6.84	16.0	1.09
1928	7.93	17.0	1.35
1929	7.80	17.5	1.36

Sales data by National Fertilizer Association, except 1929 which is *Chem. & Met.* estimate; plant food estimates by *Chem. & Met.*


FERTILIZER USED ON VARIOUS CROPS IN 1927
(97.5 Per Cent of Total U.S. Consumption)
Crop
Per Cent
Cotton 31.4 2,108,000 Tons
Corn 22.5 1,509,000 Tons
Potatoes 10.3 688,000 Tons
Wheat 10.2 682,000 Tons
Tobacco 7.0 470,000 Tons
Oats 4.9 326,000 Tons
Citrus 3.6 241,000 Tons
Hay 2.7 184,000 Tons
Sweet Potatoes 1.7 112,000 Tons
Tomatoes 1.2 78,000 Tons
Vegetables (Misc.) 0.9 60,000 Tons
Peanuts 0.7 49,000 Tons
Buckwheat 0.4 26,000 Tons
Watermelons 0.3 22,000 Tons
Barley 0.3 20,000 Tons
Rye 0.3 18,000 Tons
Peaches 0.2 15,000 Tons
Sweet Corn 0.2 14,000 Tons
Rice 0.2 13,000 Tons
Strawberries 0.2 13,000 Tons
Beans (Dry) 0.2 12,000 Tons
Cucumbers 0.1 8,000 Tons
Soy Beans 0.1 7,500 Tons
Cabbage 0.1 6,000 Tons
Cantaloupes 0.1 4,500 Tons
Sugar Beets 0.1 4,500 Tons
Onions 0.1 4,500 Tons
Cow Peas 3,000 Tons
Sugar Cane 2,000 Tons
These figures include fertilizers applied as side and top dressing
Estimate based on consumer survey

In addition to these concerns in the various size groups of the fertilizer industry proper, there are, of course, two other groups, which are producers or marketers of fertilizer chemicals. One of these auxiliary divisions of the industry includes those chemical engineering enterprises which manufacture ammonia and synthetic nitrogen products, cyanamide, potash, and superphosphate for sale to fertilizer companies. The second auxiliary group is merely a merchandising group, including as its most conspicuous examples those concerns which sell byproduct ammonium sulphate, imported potash, or imported Chilean nitrate, in large part to fertilizer companies and fertilizer mixers, but also in substantial measure direct to farmers or co-operative farm groups.

The fertilizer industry has not escaped the merger vogue, though this current fashion has not produced as conspicuous effects in this as in some other branches of chemical engineering enterprise. There have been a substantial number of consolidations, perhaps most conspicuously in the case of the Davison Chemical Company, which has absorbed a considerable number of smaller concerns, apparently to round out its distribution system or strengthen its commercial structure throughout the areas it desires to serve. The most notable corporation changes during the year took place too late to have significant effect on operations of 1929. They were the decision of the duPont organization definitely to enter the fertilizer business and the decision of the Koppers Company to market ammonium sulphate. In the latter case apparently the methods of selling and the economic situation will not be greatly changed, since preliminary announcements imply merely that the Koppers organization will sell sulphate instead of having all of its production marketed by the Barrett Company. The entry of duPont interest into the fertilizer industry represents a much more important change. However, it is one that cannot yet be appraised, since no announcement has been made as to whether this concern is going to build up its own selling agency or whether it will take over some existing organization by outright purchase, or whether it will make sales contracts with fertilizer companies now in the field, thus creating a controlled but corporately independent sales structure.

Chemical engineering methods and managements were more prominent in the fertilizer business at the end of the year than at its beginning. The example of the entry of the duPont group is but one of the several evidences of this fact. Apparently the most striking commercial advances, and perhaps the most profitable operations of the year, have been those made by concerns of highly technical direction and distinctly chemical engineering in type. Old school managements do not seem to have fared quite as well in most cases, if one can properly judge either from stock-market features or from reported earnings on stocks. Of the twelve largest companies already referred to, just about half can be characterized as distinctly chemical engineering in type and management. It would not be surprising if the close of another year would show this half dozen even more strongly intrenched in their present positions among the leaders of the business.

The other half dozen large concerns, and many of the smaller companies, are undoubtedly due for distinct change in system. Otherwise it may be expected that they will become less important parts of the business, or perhaps even pass out of the industry altogether. The changes which can be foreseen for this type of concern are of four sorts. They may fail and pass through reorganization because of financial difficulties; they may be taken over by other concerns and thus disappear as independent units; they may become mere mixers and distributors, using the products of chemical engineering companies and abandoning their own manufacturing operations; or they may change their habits and become in themselves of distinctly chemical engineering type. It would, of course, be rash to forecast how many or which particular companies will follow each of these several routes. It does seem definitely established, however, that the day of the old-fashioned concern of rule-of-thumb management is rapidly passing even in the fertilizer industry.

Table III—Size of Fertilizer Companies

Classified by value of sales per establishment, Bureau of the Census for sales of calendar year 1927

Annual Sales (Thousands of Dollars)	Number of Establishments	Number of Wage Earners	Aggregate Value of Products	Value per Wage Earner
5 to 20	46	92	$561,000	$6,100
20 to 100	155	836	8,410,000	10,100
100 to 500	247	6,302	63,217,000	10,000
500 to 1,000	104	6,714	73,061,000	10,900
over 1,000	35	5,700	61,525,000	10,800
	587	19,644	$206,774,000	$10,500

Phosphates

Record Changing Conditions

SUPERPHOSPHATE production in 1929 was 1 per cent below that of the preceding year, according to the best available estimates. This situation corresponds closely to the situation in the fertilizer industry generally, which suffered a slight decline in total production and sales as compared with the preceding calendar year. At the end of the year stocks of superphosphate, both in bulk and in stocks of mixed and base goods on hand in piles of producers, were also slightly below the tonnage of this material in storage a year ago.

A comparison of superphosphate tonnages over a long period indicates a growth in output of this basic fertilizer chemical; but tonnages alone do not tell the full story. Over the 30-year period from 1899 to 1929 there was an increase from approximately 3,000,000 to a little over 4,000,000 tons, or nearly 40 per cent growth in output. But simultaneously there was a substantial increase in concentration of available P_2O_5 in the superphosphate, the concentration growing from an estimated average of approximately 14 per cent at the beginning of the century to something more than 17.5 per cent during the past year. Thus there was an increase of 25 per cent in concentration of this plant-food constituent and the tonnage of P_2O_5 increased from about 420,000 tons in 1899 to approximately 720,000 tons last year, or a growth of 70 per cent in 30 years.

The inroads of North African phosphate developments on world markets previously dominated by the United States phosphates continued during the past year. These developments even reached the point of dumping of Moroccan phosphate on the American market at prices claimed to be much below cost, certainly below the prices at which similar goods from the same source were sold in Europe. As a consequence taxation of this phosphate under the anti-dumping act was invoked in an effort to protect the American industry by the tariff measures which were enacted a few years ago as a general safeguard against just such occurrences.

The main concern of both phosphate-rock and fertilizer manufacturers, in this matter, is that which will come about through reduced tonnages of production at American works. Obviously, if the American phosphate industry is to be restricted to domestic markets, through appropriation of foreign markets by African phosphate, then the unit costs will be increased at all United States plants which have hitherto had substantial export sales. Fortunately, thus far the increased exports of superphosphates and of land pebble and other low-grade rock, have more than offset the decreased export of high-grade hard phosphate rock. Thus the American industry as a whole has not felt the large restrictive influence which has been feared as a consequence of European competition of North African phosphate. Japanese and far eastern markets have increased in sufficient amount to offset the reduction in European trade.

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Apparently Moroccan production of phosphate has continued during 1929 at nearly 20 per cent above the rate for the preceding year. Statistics are not available from Tunis and Algiers, but it is known that these other North African producing areas continued active and had an important part in supplying the European market. Toward the end of 1929 it was reported that negotiations were still in progress for the establishment of a commercial entente by which it was hoped to fix phosphate prices in Europe at a somewhat higher level through collaboration of the interests working in the three North African dependencies. Some have assumed that the effect of such entente might be beneficial to American producers, because it would maintain a more favorable world price level; but little can be forecast as to the consequences of this commercial development, if and when it comes.

TECHNICAL developments in the United States affecting fertilizer phosphates in 1929 followed along lines which have been previously noted in *Chem. & Met.* The factors affecting cost of phosphate-rock production and methods for its utilization were reviewed in the July issue (page 411), in connection with the last annual meeting of the National Fertilizer Association. The important significance of ammoniation of phosphate during fertilizer making has also been very fully reviewed (article by R. S. McBride, page 592, issue of October).

The third technologic factor of consequence, the influence of which is still to be determined, is the development of phosphoric acid by furnace methods, either to supplement acidulation methods or to supersede them in the making of fertilizer chemicals. Thus far both electric-furnace and fuel-fired-furnace methods have been on an experimental basis so far as phosphoric acid for fertilizers is concerned. The comparative advantage of these two procedures has been analyzed in *Chem. & Met.* (article by B. G. Klugh, page 666, issue of November, and comment by August Kochs, page 741 in December). It is therefore, unnecessary to review that phase of the economic technologic development further here. Two new phosphoric-acid furnaces are reported to have begun operation during 1929, in the plants of the Victor Chemical Company and the Tennessee Products Company.

HOWEVER, it is important to note that the blast-furnace method of phosphoric-acid making which was discussed at a recent chemical meeting by Royster and Turrentine is really quite distinct from the so-called fuel-fired-furnace methods hitherto widely considered. The blast-furnace procedure charges a mixture of rock, coke, and slagging material and produces the requisite heat by combustion of the coke, just as does the iron-blast furnace. The typical fuel-fired phosphoric-acid furnace, although using some coke in the charge as a reducing agent, has been assumed to get the heat required for raising the charge to reaction temperatures from gaseous or liquid fuel burned under grates or in a combustion chamber at the base of the stack. The calculations of Royster and Turrentine above referred to forecast very low cost phosphoric acid, for large tonnages as low as $16 per ton of P_2O_5. These calculations are, however, based essentially on a theoretical consideration of the problem, and furthermore are admittedly not complete, as they do not include all general expense items, nor do they allow anything for management profit or sales expenses. They do show, however, the interesting possibilities which may later develop when commercialization of such schemes proves practicable.

Sales of Domestic Phosphate Rock According to Uses

Data for 1928 as reported to U. S. Bureau of Mines

	Long Tons
For superphosphate	2,339,000
Phosphorus and phosphorous chemicals	181,000
Direct application to soil	42,000
Blast furnace for ferrophos	21,000
Poultry and stock feed	5,000
Other uses	15,000
	2,603,000

Potash

Expansion in Domestic Output

By J. W. TURRENTINE

In Charge, Potash Investigations Bureau of Chemistry and Soils, U. S. Department of Agriculture

AMERICAN potash production in the year 1929 was maintained on the higher level established in 1928, when substantial gains were made in total output, namely from 77,000 tons of potash salts in 1927 to 104,000 tons in 1928. This tonnage, as formerly, is the contribution of two major plants in which the respective raw materials are natural potash-borax brines and distillery waste from alcohol manufacture. The bulk of this production is high-grade muriate which finds ready acceptance both in the fertilizer industry, for the manufacture of high-analysis fertilizers, and in the chemical industries. In both plants, a mutual interdependence prevails between major and minor products which operates to restrict production, so that expansion in both doubtless will continue to depend on the expansion of the market for the associated products. The expansion in the market for borax, a byproduct of potash manufacture, represented by an increase of 60 per cent in American exportations in 1928, illustrates this principle, and further, the economic advantage to be gained from byproduct development.

Further expansion of the American potash industry may be anticipated as the result of gradual development and conservative growth. Substantial projects are now under expert examination, from some of which the establishment of new production units may confidently be expected. Both public and private research is being directed to this end. Further, potash explorations in the Texas-New Mexico area extend the boundaries of the known deposit there. The other outstanding deposits of potash-bearing minerals are being exhaustively investigated from the technical viewpoint. The extension of the areas of fertilizer usage calls for cheaper potash—that is, potash freed from present high transportation costs—which demands the exploitation of close-by potash resources. America remains the principal market for foreign potash entering transoceanic trade, absorbing 12 per cent of German production and 32 per cent of German exportations. These figures connote the market still awaiting domestic supplies.

Importations of potash fertilizer salts into the United States showed a marked decline in 1929, as compared with 1928, on the basis of the first nine months of the year. This decline affected all grades of salts in this class and in the aggregate amounted to a decrease from 672,354 tons valued at $14,805,063, in 1928, to 558,990 tons valued at $12,692,300 in 1929, representing a decrease of 17 per cent in tonnage and 14 per cent in value. In the same period importations of potash salts for chemical, as contrasted with fertilizer, purposes, increased from 47,794,000 lb. valued at $3,028,000 in 1928 to 67,635,000 lb. valued at $4,310,000 in 1929, representing an increase of 41 per cent in both quantity and value.

American prices on all potash fertilizer salts, as announced on May 1, 1929, by the German-French importers, showed an advance of from 10c. to 35c. per ton and were guaranteed against a decline for a period of one year.

IN Germany the potash industry in 1929 maintained its high order of activity established in 1928, which was a record year. Further amalgamations have been effected in the industry, with the result that it is now concentrated in only six production groups. Capitalization has been increased, and dividends of 10 to 15 per cent were paid in 1929 by certain groups, despite wage increases in the preceding year. Sales in the first ten months of 1929 amounted to 1,217,182 metric tons of actual potash (K_2O), as compared with 1,231,607 tons in the same period of 1928 and 1,070,823 tons in 1927. The monthly sales varied from 233,000 tons in March to 77,326 tons in May. Assuming for November and December sales equalling those of the corresponding months of 1928, namely 82,500 and 107,000 tons, respectively, the total for 1929 would be about 1,407,000 tons, as compared with 1,420,000 tons in 1928.

Although for a number of years exportations by German producers have represented a steadily increasing percentage of production, the last fertilizer year showed a marked increase in the tonnage of potash used in domestic agriculture, which fact is explained on the basis of rapid increase in the use of the new, highly concentrated complete fertilizer mixtures, such as "nitrophoska"—a compound of potash, nitrogen, and phosphates. The growing popularity of these highly fabricated products has enlisted the interest of the potash producers who appreciate the economies to be realized in the distribution of the more concentrated and better balanced mixtures, as contrasted with the old, more dilute simples. In fact, the continuing transition of the industry to a chemical basis, as compared with the purely mining basis of its earlier years, is indicated in several other ways, and may be illustrated further by the present stage of development of byproducts, such as bromine, magnesium chloride, magnesium sulphate, sodium sulphate, sodium chloride, and caustic potash, aggregating a gross profit of about 30,000,000 marks. New and enlarged potash storing and loading facilities have been put into commission at the harbors of Hamburg and Bremen. Internal prices have remained stationary.

In France further increase in production have been registered, as indicated by the output of 318,450 metric tons actual potash in the first eight months of 1929, compared with 258,510 metric tons in the corresponding period of 1928, representing an increase of 23 per cent. This is an average production of 39,800 tons per month, on which basis the year's output would be about 478,000 tons. Further advances have been made in the chemical refining of the crude salts and the recovery of byproducts, notably bromine. Improved storage and loading facilities have been installed at the harbor of Antwerp. A tax on production, amounting to 4.375 francs per ton of actual potash, is now imposed by the French government, proceeds from which are used in educative propaganda to promote the domestic use of potash fertilizers—a policy that is yielding the anticipated results.

Developmental activities have been continued in other countries, notably in Poland, Russia, Spain, Italy, and Chile. Poland's production has not yet reached domestic requirements, which are considerable, whereas Spain, with but minor requirements and with one mine in production and a second under development, has made small foreign shipments. No immediate prospect exists that any of these actual or potential producers will enter the foreign market with important tonnages of potash. To what extent possible governmental subsidies in Russia may be used to overcome natural transportation difficulties as they relate to the Russian deposits, however rich and extensive the deposits may be, remains for future years to disclose.

The potash industry of the world seems, on the whole, to possess an enviably secure economic position. The German-French combine, enjoying the solicitude of the respective governments, not only has appreciative home markets but uncontested foreign trade. The advance in scientific agriculture the world over and the trend toward intensive agricultural methods, of both of which artificial fertilization is a *sine qua non*, would appear to guarantee an expanding market for potash.

Plastics

New Fields Incite Multiplied Output

UNSUSPECTEDLY VAST figures characterize the upward swing of the plastics industry at the close of 1929, much after the example of rayon, its next of kin. While affairs progress rather chaotically and with some eccentric ramifications peculiar to this spurt, the obtainable estimates vary only in the exact degree of their magnitude. It is impressive, for example, that the rate of output for one class of compositions alone is now conservatively judged to be higher than the yearly output of all classes three years ago.

Cellulose-Base Plastics

Safety glass, involving the use of sheet pyroxylin, has been the outstanding recent factor in this group and will be the object of further discussion in later issues of *Chem. & Met.* Meanwhile, for the year 1929 it has represented about 2,500,000 lb. of the total nitrate plastic produced, which has run close to 30,000,000 lb. Another 12,000,000 lb. may be allotted to the novelty and trade article consumption.

Prospects for 1930 point to a similar total output, with a possibility of increased poundage due to safety-glass.

This annual production represents about 15,000,000 lb. of cotton linters, 35,000,000 of acid (nitric and sulphuric), 15,000,000 of alcohol, and 7,000,000 of camphor. A rather steady course of prices is forecast here too; cotton linters saw a slight decline late in 1929, while camphor faces a possible rise. Alcohol prices, now stabilized by the producers' organization, are higher because of increased raw material costs.

The market situation in regard to sheeting for safety-glass presents some special complications. With Ford the largest consumer and his incursions into Europe for a cheaper supply during the fall, estimates of domestic production vary from 1,500,000 to 2,500,000 lb., an increase over 1928 of a million lb., anyway. Imports are said to be about 800,000 lb. Germany with her "celluloid trust" can produce her 27,000,000 lb. a year cheaply enough to sell sheeting here at 65c. per pound plus the duty of 40c.; and the announced entrance of Japan in the field promises a still livelier issue. American makers, with a highly-developed and superior product, must sell at $1.30 and $1.40 per pound, and are hence asking more liberal consideration in the tariff.

The market involved, at any rate, represents some 20,000,000 lb. annually of pyroxylin sheeting for automobiles alone, assuming complete laminated-glass equipment. And the tendency is for the adoption of the same material in the public carriers.

Celluloid acetate plastics are the other, although much more recent, member of this group. Their advantages over pyroxylin are in the minimized hazard and better coloration, so that everyday goods and film are its promising fields. Even so, the production of molded products from acetate was 750,000 to 1,000,000 lb. in 1929 and is expected to rise in 1930. Molding powders also represent a new extension of this compound, and the film has received a fresh stimulus from the numerous pyroxylin film catastrophes throughout the year.

The prevailing prices for the plastics, ranging from $0.65 to $1.25 a pound, are expected to continue for 1930, although the film is slated for a moderate reduction.

Phenol-Type Resins

Unlike the cellulose group of plastics, in which four major companies are active, the phenolic resins are manufactured by an unlimited host of fabricators and producers who are now sharing the field with the original pioneer concern. Although the major product of this group is phenol-formaldehyde, with fillers or alone, there are other compounds involving furfural, xylenol, and cresol. They represent less than 5 per cent of the output, but in the case of phenol-furfural, for example, plans for 1930 call for a four-fold increase.

Based on unofficial estimates, the total output of synthetic resins should reach 33,000,000 lb. for 1929, although some authorities would raise this figure well beyond 40,000,000 lb. Either way, the rate of increase is suggested by a comparison with the official figures of 13,452,230 lb. in 1927 and 20,411,000 lb. in 1928. What the coming year will hold is entirely a matter of conjecture, based on plans for synthetic phenol production and on remarkable development in molding technique. For although electrical insulation has been the major use (and 200,000,000 radio tube bases made in 1929 were 25 per cent over the 1928 figure) the real field is now indicated by such events as the development of resins for large-scale molded furniture, beds, interior trim, building, vehicle bodies, hardware, machinery, and the like. A company that is proceeding with this type of work manufactures its own resin and is expected to produce as much as the entire field did two years ago. Other valuable technical contributions in the molding line are being worked out at present and if successful will add to the avalanche.

Intimately tied up with the synthetic resin expansion has been the supply of raw materials, especially the phenol. After the high year 1925, when production was 14,734,065 lb., and the drop to 8,691,181 lb. in 1926 and 9,607,000 lb. in 1928, the synthetic producers have been called on to fill the rising needs of the resin field. Early in 1929 the market became pressed and the waning imports (only 1,193 lb. in 1928) jumped to 168,159 lb. for the past year up to August. Even so, it is estimated that domestic consumption exceeded 26,000,000 lb. for the year, of which the synthetic domestic production supplied 18,000,000 lb. This acceleration now proceeds at a rapid rate, so that one concern is attaining 1,500,000 lb. a month now, with prospects of 4,000,000 lb. a month late in 1930, and again a redoubled output a year later. With another producer up to 500,000 monthly, an estimate of 50,000,000 lb. for phenol in 1930 would be a conservative figure and, incidentally, in line with an 80 to 90 millions-lb. year for resins.

Any formaldehyde demands from the plastics industry should be taken care of by the production schedules of the new synthetic producing plants.

Miscellaneous Plastics

Urea-formaldehyde plastics, now in a commercial higher-price class, were produced to an initial amount of 10,000 lb. in 1929, mostly sample goods. For 1930, however, a tenfold increase is predicted together with an attendant lowering in price.

Glycerine-phthalic anhydride seems, on investigation, to have been used considerably less as a solid plastic than has often been supposed. In the coating field though, it appears in two varieties, one containing organic acids and retarders. The distinction apparently rests in the reduced amount of nitrocellulose necessary for admixture to the soluble variety and in the specific uses proposed for them. Far-reaching developments seem to be under way in this field, one of them concerning a very promising lacquer for metal surfaces.

Styrol plastics have left the laboratory and are being adapted to plant production, where long strides are expected in 1930. A nominal price attaches to them, but the raw material, ethyl benzol, is expected to be no commercial obstacle.

The vinyl resins have been publicly announced and, although being offered only in sample lots, should undergo a gradual price reduction. They too have attractive properties that should find them a place in the scheme of things.

Rayon

Increases 35 Per Cent in 1929

DESPITE a year in which increasing competition has played havoc with the price situation, the rayon industry has emerged in what appears to be good shape. Price cuts in February and June dropped the selling figure to $1.15 from $1.50 per pound of first quality 150-denier viscose rayon, a price which had been maintained quite steadily for two years. It is believed, however, that this situation is transient and that overcapacity of the industry, if it exist at all, will be of short duration. The rayon output of the past year, by far the largest on record, seems to have been well absorbed, and it is believed that the stocks on hand at the end of 1929 were not abnormally large.

When it was predicted at the beginning of the past year that rayon production could be expected to increase by 30 per cent over that of 1928, the prophet felt it necessary to defend his optimism. What actually happened, according to *Textile World's* annual estimate for 1929, was that production increased to 131,325,000 lb., a rise of almost 35 per cent. Of this, 110,525,000 lb. was viscose, 7,500,000 lb. acetate, 2,300,000 lb. cupra-ammonium, and 11,000,000 lb. nitrocellulose.

This phenomenal increase is not so difficult to understand when the now complete acceptance of synthetic fibers by the public is taken into consideration. Between the work of the textile mills and designers in developing new fabrics, the producers in improving their products, and the Rayon Institute in convincing the public through educational advertising that rayon is a new and valuable fiber and not a mere substitute for silk, the public has been won over very completely. When it is further considered that the present production of rayon is only about 3½ per cent of that of cotton in the United States, it would appear that the end of expansion is not yet in sight. Hence no defense is necessary for the prediction that the current year will bring about a further increase over the production of 1929 of about 32 per cent, with a total of 173,000,000 lb.

Consumption has, as in the past, outstripped production by a considerable margin. With imports placed at the estimated figure of 16,430,000 lb. (based on the assumption that the average rate for the first ten months was maintained the balance of the year), the total probable consumption reached the sizable figure of 147,755,000 lb., over 11 per cent in excess of production. It is interesting to note that out of the 17 principal producing countries, the United States alone accounted for very nearly one-third of the estimated total world production of 396,125,000 lb., and over 37 per cent of the consumption. This means a per capita utilization of synthetic fibers equal to 1.2 lb., or about 36,000 yd. of 150 denier yarn.

The United States produces today about 2⅔ times as much rayon as its nearest competitor, Italy, for which a 1929 production of 50,000,000 lb. has been estimated. It is an important fact, however, and one fraught with unpleasant consequences in the opinion of certain commentators, that about 60 per cent of the United States producing capacity is controlled abroad. By all odds the largest producer, Viscose Company, is owned almost completely by Courtaulds, Ltd., a British company which is said to control about 80 per cent of the world's rayon output. With four other large rayon producers all believed to be controlled outside the United States, rayon manufacture takes on an international aspect unparalleled in any other branch of the chemical engineering industry.

Production in most foreign countries gradually caught up with demand during 1928, and the effort to bolster an unstable equilibrium by means of artificial price agreements met at first with signal failure. Prices in many cases actually fell below production costs. The latter part of last year, however, brought gradual improvement, with the strengthening of intra- and international ties. The most important of these include the Italian Convention, a cartel of the four principal Italian companies, and the General Synthetic Fiber Union (Aku), a combination of the powerful Dutch Enka and the German Glanzstoff concerns. Both of these companies have American subsidiaries. The Aku now controls more than half of the German and the larger part of the Dutch production. It is impossible to predict the far-reaching effects that may come out of this combination, especially in view of the fact that the Courtaulds concern has a finger in the new consolidation.

The largest German producer of cupra-ammonium yarn, J. P. Bemberg, A. G., maker of over 80 per cent of the German output of this product, likewise has an American subsidiary, until now the only cupra-ammonium producer in the United States. This situation is likely to be changed shortly by at least one American producer of cupra yarn whose plant is now in the experimental stage. Italian interests, concerned in the Italian Convention, are affiliated with still another American company producing viscose and acetate silks. This is American Chatillon, which, however, is reported to be controlled in the United States. A fifth company, Celanese Corporation, making at present the greater part of the acetate fiber produced in the United States, is closely affiliated with the British Celanese Company, although it is uncertain in which country control rests in this case. It is believed that the American company is still subsidiary to the British. Finally, the American Acetate Silk Company has been formed on a share-for-share basis, according to reports, by the American Chatillon and Tubize Artificial Silk companies. This places at least a part of the control in foreign hands.

In addition to stock affiliations, other American companies have close patent and other technical connections with foreign con-

Table I—U.S. Production and Imports, 1922–1929

(Tariff Information Survey and *Textile World*)

Thousands of Pounds

	U. S. Production	U. S. Imports	World Production
1913	1,566	2,306	29,156
1922	24,406	2,088	80,894
1923	35,400	3,906	108,800
1924	38,750	1,712	141,164
1925	52,200	7,001	182,984
1926	62,575	10,127	219,080
1927	75,050	16,223	266,868
1928	98,650	12,754	347,400
1929	131,325*	16,430**	396,125*

*Estimated
**Estimated on basis of first ten months' imports

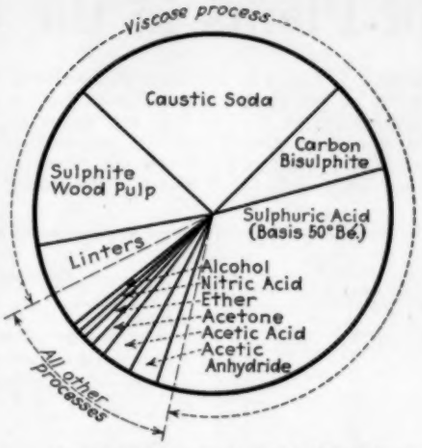
29 Plants, Operated by 20 Rayon Producers, Are Distributed Through 15 States, All East of the Mississippi

cerns. The duPont acetate rayon is said to be made under French Rhodiaseta patents, although the considerable ownership in the DuPont Rayon Company which was formerly held by the French Comptoir des Textiles Artificiels, has been taken over completely by the parent duPont company. Both Tubize and Belamose have technical affiliations with Belgian concerns. Skenandoa is reported as having a consulting arrangement with the French Strasbourg interests.

It is perhaps the very complexity of the European situation which has attracted foreign concerns to the United States. During 1927 and 1928 respectively, the Bemberg and Glanzstoff plants commenced production, while 1929 saw the first rayon produced commercially by the American Enka and Chatillon plants. Several new or already established companies started up new plants, including an acetate unit at Meadville, Pa., owned by the Viscose Company, and two new duPont operations—a viscose unit at Richmond, Va., and an acetate plant at Waynesboro, Va. The New Bedford (Mass.) Rayon Company went into operation, while its affiliated company, the Woonsocket (R. I.) Rayon Corporation neared the commercial production stage. Furness Corporation, at Gloucester City, N. J., and the A. M. Johnson Rayon Mills, at Burlington, N. C., were both operating on a semi-commercial scale, according to reports, although definite information as to the present status of production of these companies is not available.

Much of the foregoing information is summarized in Table II, which gives, among other data the location of plants, the processes used and estimated production for 1929 and the current year. It is to be noted that actual production may vary considerably from estimates because of changes in the relative demand for various deniers.

This condition is of interest to the industries which supply the raw materials of rayon manufacture. Actual pound output is the only criterion for estimating the demand for raw materials, as plant size or the number of operatives employed are proportional to the output only when the type of production is taken fully into consideration. In preparation of the raw material estimates shown in Table III and illustrated diagrammatically in their relation to one another in the accompanying segmental chart, this condition has been recognized.



Relative Proportions of Principal Raw Materials Entering Into Rayon Manufacture (Based on Table III)

Table III—Estimated U. S. Consumption of Principal Raw Materials of Rayon Manufacture, 1929

Material	Short Tons
Sulphuric acid (basis 50 deg. Bé.)	145,000
Caustic soda	105,000
Sulphite Wood Pulp	63,000
Cotton Linters	33,000
Carbon bisulphide	33,000
Nitric acid (100 per cent)	2,700
Ethyl Alcohol	2,800
Ether	4,300
Acetone	5,600
Acetic acid	11,000
Acetic Anhydride	11,000

Table II—Data Concerning United States Rayon Producers

Company	Started Production	Estimated Per Cent U. S. Ownership[1]	Plants	Process	Estimated Capacity with Present Construction Completed	Estimated Production (*Textile World*) Million Lb. Units	
						1929	1930
Viscose Company	1911	15	Marcus Hook, Pa. Lewistown, Pa. Parkersburg, W. Va. Roanoke, Va. Meadville, Pa. Nitro, W. Va.	Viscose Viscose Viscose Viscose Acetate Linters	25.0[1] 17.0[1] 17.0[1] 17.0[1] 5.0[1]	66.0	80.0
Du Pont Rayon Company	1921	100	Buffalo, N. Y. Old Hickory, Tenn. Richmond, Va. Waynesboro, Va.	Viscose Viscose Viscose Acetate	6.5[1] 15.5[1] 4.0[1] 1.5[1]	25.1	28.0
Tubize Artificial Silk Company	1921	95	Hopewell, Va.	Nitro		11.0	12.0
Celanese Corporation of America	1925		Amcelle, Md.	Acetate		7.0	8.0
Industrial Rayon Corporation	1921	100	Cleveland, O. Covington, Va.	Viscose Viscose	4.5[2] 5.5[2]	6.5	11.0
American Glanzstoff Corporation	1928	Under 49	Elizabethton, Tenn.	Viscose		3.575	8.0
American Bemberg Corporation	1927	Under 49	Johnson City, Tenn.	Cupra		2.3	4.0
American Chatillon Corporation	1929	Over 51	Rome, Ga.	Viscose Acetate	4.3[2] 2.5[2]	1.5	6.2
American Enka Corporation	1929	Under 5	Asheville, N. C.	Viscose	10.0[2]	1.0	4.5
Skenandoa Rayon Corporation	1928	100	Utica, N. Y.	Viscose		1.35	3.25
Delaware Rayon Corporation	1927	100	New Castle, Del.	Viscose		2.0	2.0
New Bedford Rayon Company	1929	100	New Bedford, Mass.	Viscose		0.4	1.25[1]
Belamose Corporation	1925	100	Rocky Hill, Conn.	Viscose		1.7	1.7
Acme Rayon Corporation	1924	100	Cleveland, Ohio	Viscose		0.9	1.0
Amoskeag Mfg. Company		100	Manchester, N. H.	Viscose	1.5[2]		
Roseland Corporation	Inactive	100	Paterson, N. J.	Cupra			
Furness Corporation	Experimental	100	Gloucester City, N. J.	Cupra	3.6[2] (planned)		
A. M. Johnson Rayon Mills	1929	100	Burlington, N. C.	Viscose	14.4[2] (planned)		1.0[1]
Napon Rayon Corporation	Inactive	100	Clifton, N. J.	Cupra			
Woonsocket Rayon Corporation	Experimental	100	Woonsocket, R. I.	Viscose			
American Acetate Silk Company	Projected	75	Hopewell, Va. (probably)	Acetate	2.25[2]		

[1]Independent estimate. [2]*Textile World* estimate. [3]"The Rayon Industry," M. H. Avram, Van Nostrand, 1929.

Sulphuric Acid Plants in the United States

This tabulation of sulphuric acid plants in the United States represents, so far as is known, the first comprehensive list of the type to be published. It is realized that errors will, in all likelihood, be present in spite of the effort which has been made to check and recheck the list with all available sources for this information. *Chem. & Met.* will appreciate information regarding any corrections that should be incorporated in similar tabulations which may be published in the future.—*Editor.*

Company	Location	Type	
		Chamber	Contact
Alabama—Total		14	1
American Agricultural Chemical Co.	Montgomery	X	
du Pont de Nemours & Co., E. I.	Mineral Springs		X
Farmers' Fertilizer Co.	Montgomery	X	
Home Guano Co.	Dothan	X	
Jefferson Fertilizer Co.	Bessemer	X	
Planters' Chemical & Oil Co.	Talladega	X	
Roanoke Guano Co.	Roanoke	X	
Royster Guano Co., F. S.	Birmingham	X	
Standard Chemical Co.	Troy	X	
Steel Cities Chemical Co.	Ensley	X	
Virginia Carolina Chemical Co.	Birmingham	X	
	Dothan	X	
	Mobile	X	
	Opelika	X	
	Selma	X	
Arizona—Total		1	1
Apache Powder Co.	Douglas		X
Calumet & Arisona Mining Co.	Douglas	X	
Arkansas—Total		4	
Arkansas Fertilizer Co.	Little Rock	X	
Commercial Acid Co.	Augusta	X	
Ellory-Davis Corp.	Little Rock	X	
Southern Acid & Sulphur Co.	Little Rock	X	
California—Total		6	6
American Agricultural Chemical Co.	Los Angeles	X	
Barbour Chemical Works	Melrose	X	
Domingues Chemical Co.	Domingues		X
General Chemical Co.	Bay Point		X
	El Segundo		X
Hercules Powder Co.	Pinole (Not operating)		X
Mountain Copper Co.	Martinez	X	
Stauffer Chemical Co.	Los Angeles	X	X
	San Francisco	X	
	Stege	X	X
Colorado—Total		1	2
du Pont de Nemours & Co., E. I.	Louviers (Not operating)		X
General Chemical Co.	Denver		X
Western Chemical Mfg. Co.	Denver	X	
Connecticut—Total		2	
Kalbfleisch Corporation	Waterbury	X	
Naugatuck Chemical Co.	Naugatuck	X	
Delaware			
General Chemical Co.	Claymont		X
Florida—Total		5	1
American Agricultural Chemical Co.	Pensacola	X	
American Cyanamid Co.	Tampa (Building)		X
Armour Fertilizer Works	Jacksonville	X	
Barker Chemical Co.	Dunnellon	X	
Painter Fertilizer Co., E. O.	Jacksonville	X	
Wilson & Toomer Fertilizer Co.	Jacksonville	X	
Georgia—Total		32	
American Agricultural Chemical Co.	Savannah	X	
Armour Fertilizer Works	Atlanta	X	
	Columbus	X	
Blackshear Mfg. Co.	Blackshear	X	
Cotton States Fertilizer Co.	Macon	X	
Empire State Fertilizer Co.	Athens	X	
Furman Fertilizer Works	East Point	X	
Georgia Fertilizer Co.	Valdosta	X	
Home Guano Co.	Columbus	X	
International Agricultural Corp.	Columbus	X	
McCabe Chemical Co.	Macon	X	
Mandeville Mills	Carrollton	X	
Morris Fertilizer Works	Atlanta	X	
Mutual Fertilizer Co.	Savannah	X	
Pelham Phosphate Co.	Pelham	X	
Phosphate Mining Co.	Savannah	X	
Reliance Fertilizer Co.	Savannah	X	
Royster Guano Co., F. S.	Macon	X	
Savannah Guano Co.	Savannah	X	
Southern Fertilizer & Chemical Co.	Savannah	X	
Southern States Phosphate Co.	Augusta	X	
Southern Sulphur Oil Co.	Athens	X	
Southern Sulphur Ore Co.	Columbus	X	
Swift Fertilizer Co.	Atlanta	X	
Tennessee Chemical Co.	Albany	X	
Trout Co.	Lagrange	X	
Virginia-Carolina Chemical Co.	Atlanta	X	
	Augusta	X	
	Columbus	X	
	Macon	X	
	Rome	X	
	Savannah	X	

Company	Location	Type	
		Chamber	Contact
Illinois—Total		13	4
American Smelting & Refining Co.	East St. Louis	X	
American Zinc, Lead & Smelting Co.	East St. Louis	X	
	Hillsboro	X	
Anaconda Copper Mining Co.	Chicago Heights	X	
Armour Fertilizer Works	Chicago Heights	X	
Central Chemical Co.	West Hammond	X	
Commercial Acid Co.	East St. Louis	X	
Eagle-Picher Zinc Co.	Hillsboro (Not operating)		X
General Chemical Co.	South Chicago		X
Hegeler Zinc Co.	Danville	X	
Illinois Zinc Co.	Peru	X	
Lanyon Zinc & Acid Co., Robert	Hillsboro	X	
Matthiessen & Hegeler Zinc Co.	La Salle	X	
Monsanto Chemical Works	Monsanto	X	X
New Jersey Zinc Co.	Depue		X
Victor Chemical Works	Chicago Heights	X	
Indiana—Total		2	2
Grasselli Chemical Co.	Grasselli	X	X
Rauh & Sons Fertilizer Co.	Indianapolis	X	
Stauffer Chemical Co.	Hammond		X
Kansas			
National Zinc Co.	Argentine	X	
Kentucky			
Grasselli Chemical Co.	Wurtland		X
Louisiana—Total		6	3
Armour Fertilizer Works	New Orleans	X	
Louisiana Chemical Co.	Baton Rouge		X
Planters' Fertilizer & Chemical Co.	New Orleans	X	
Southern Acid & Sulphur Co.	Bossier City		X
Stauffer Chemical Co.	Baton Rouge	X	
Swift Fertilizer Co.	New Orleans	X	
Texas Chemical Co.	Baton Rouge		X
Union Seed & Fertilizer Co.	Gretna	X	
Virginia-Carolina Chemical Co.	Shreveport	X	
Maryland—Total		10	3
American Agricultural Chemical Co.	Baltimore	X	
Baugh Chemical Co.	Baltimore	X	
Davison Chemical Co.	Baltimore	X	X
Griffith-Boyd Co.	Baltimore	X	
Lancaster Chem. Co.	Perryville	X	
Mutual Chemical Co.	Baltimore	X	
Naval Proving Ground	Indian Head		X
Raisin Monumental Co.	Baltimore	X	
Royster Guano Co. F. S.	Baltimore	X	
Standard Wholesale Phosphate & Acid Works	Baltimore	X	X
Virginia-Carolina Chemical Co.	Baltimore	X	
Massachusetts—Total		6	2
American Agricultural Chemical Co.	North Weymouth	X	
Atlantic Chemical Co.	Lowell	X	
Avery Chemical Co.	Tewksbury	X	
Lowell Fertilizer Co	Lowell	X	
Merrimac Chemical Co.	Everett	X	X
	Woburn	X	X
Michigan—Total		2	2
American Agricultural Chemical Co.	Detroit	X	
Cleveland Cliffs Iron Co.	Marquette	X	
Detroit Chemical Works	Detroit		X
Grasselli Chemical Co.	Ecorse		X
Mississippi—Total		7	
Davison-Gulfport Fertilizer Co.	Gulfport	X	
International Agricultural Corp.	Tupelo	X	
Jackson Fertilizer Co.	Jackson	X	
Laurel Oil & Fertilizer Co.	Laurel	X	
Meridian Fertilizer Factory	Meridian	X	
	Hattiesburg	X	
Tupelo Agricultural Chemical Co.	Tupelo	X	
Missouri			
Atlas Powder Co.	Atlas		X
Montana			
Anaconda Copper Mining Co.	Anaconda	X	
New Jersey—Total		15	8
American Smelting & Refining Co.	Maurer	X	
American Agricultural Chemical Co.	Carteret	X	
	Chrome	X	
American Cyanamid Co.	Warners	X	X
Armour Fertilizer Works	Carteret	X	
Atlas Powder Co.	Hopatcong		X
Calco Chemical Co.	Bound Brook	X	X

Company	Location	Type	
		Chamber	Contact
New Jersey (continued)			
du Pont de Nemours & Co., E. I.	Deepwater		X
General Chemical Co.	Edgewater	X	X
Grasselli Chemical Co.	Grasselli	X	X
	Newark	X	
	Paulsboro	X	
Hercules Powder Co.	Kenvil		X
	Parlin		X
Kalbfleisch Corp.	Elisabeth	X	
King Chemical Co.	Bound Brook	X	
Mutual Chemical Co.	Jersey City	X	
Standard Oil Co. (N. J.)	Bayonne (Not operating)	X	
Thomas & Sons, I. P.	Paulsboro (Not operating)	X	
New York—Total		5	2
American Agricultural Chemical Co.	Buffalo	X	
Eastman Kodak Co.	Rochester		X
General Chemical Co.	Buffalo	X	X
(Contact Process Co. Division)	Buffalo	X	
Kalbfleisch Corp.	Brooklyn	X	
Robinson Brothers Co.	Brooklyn	X	
North Carolina—Total		17	
Acme Mfg. Co.	Wilmington	X	
American Agricultural Chemical Co.	Wilmington	X	
	Columbia	X	
Armour Fertilizer Works	Greensboro	X	
	Wilmington	X	
Caraleigh Phosphate & Fertilizer Wks.	Raleigh	X	
Dixie Guano Co.	Laurinburg	X	
McCabe Chemical Co.	Charlotte	X	
Merchants' Feed & Phosphate Co.	Charlotte	X	
Swift Fertilizer Co.	Wilmington	X	
Virginia-Carolina Chemical Co.	Charlotte	X	
	Durham	X	
	Navassa	X	
	Selma	X	
	Wadesboro	X	
	Wilmington	X	
	Winston Salem	X	
Ohio—Total		16	3
American Agricultural Chemical Co.	Cincinnati	X	
	Cleveland	X	
American Steel & Wire Co.	Cleveland	X	
Armour Fertilizer Works	Cincinnati	X	
	Sandusky	X	
Farmers' Fertilizer Co.	Columbus	X	
Federal Chemical Co.	Columbus	X	
General Chemical Co.	Cleveland		X
Grasselli Chemical Co.	Canton	X	
	Cleveland	X	X
	Lockland	X	
	Niles	X	
	Toledo		X
Jarecki Chemical Co.	Cincinnati	X	
St. Bernard Acid Works	St. Bernard	X	
Smith Agricultural Chemical Co.	Columbus	X	
Virginia-Carolina Chemical Co.	Cincinnati	X	
	Sandusky	X	
Oklahoma—Total		1	2
Mid Continental Chemical Co.	Sand Springs	X	
National Zinc Co.	Bartlesville		X
Ozark Chemical Co.	Ponca City		X
Pennsylvania—Total		17	8
American Alkali & Acid Co.	Bradford	X	
American Sheet & Tin Plate Co.	Vandergrift	X	
American Steel & Wire Co.	Donora	X	
American Zinc & Chemical Co.	Langeloth	X	
Atlas Powder Co	Tamaqua		X
General Chemical Co.	Newell		X
Grasselli Chemical Co.	Beaver Falls	X	
	New Castle	X	
	Philadelphia	X	X

Company	Location	Type	
		Chamber	Contact
Pennsylvania (continued)			
Hercules Powder Co.	Emporium		X
Kalbfleisch Corp.	Erie	X	
Lancaster Chemical Co.	Lancaster	X	
Lenning & Co., Charles	Philadelphia	X	
Merck & Co.	Philadelphia	X	
New Jersey Zinc Co.	Palmerton		X
Pennsylvania Salt Mfg. Co.	Natrona	X	X
	Philadelphia	X	X
Powers, Weightman & Rosengarten	Philadelphia	X	
Trojan Powder Co.	Seiple		X
Tunnell & Co., F. W.	Philadelphia	X	
York Chemical Co.	York	X	
United Gas Improvement Co.	Point Breeze (Phila.)	X	
South Carolina—Total		13	
American Agricultural Chemical Co.	Charleston	X	
	Columbia	X	
Anderson Fertilizer Works	Anderson	X	
Etiwan Fertilizer Co.	Charleston	X	
Maybank Fertilizer Co.	Charleston	X	
Merchants' Fertilizer & Phosphate Co.	Charleston	X	
Planters' Fertilizer & Phosphate Co.	Charleston	X	
Read Fertilizer Co.	Charleston	X	
Royster Guano Co., F. S.	Columbia	X	
Virginia-Carolina Chemical Co.	Blacksburg	X	
	Charleston	X	
	Greenville	X	
	Pon Pon	X	
Tennessee—Total		8	1
Armour Fertilizer Works	Nashville	X	
Ducktown Chemical & Iron Co.	Isabella	X	X
Federal Chemical Co.	Nashville	X	
Kalbfleisch Corp.	Nashville	X	
Read Phosphate Co.	Nashville	X	
Tennessee Copper & Chemical Co.	Copper Hill	X	
Victor Chemical Works	Nashville	X	
Virginia-Carolina Chemical Co.	Memphis	X	
Texas—Total		3	5
Armour Fertilizer Works	Houston	X	
Gulf Refining Co.	Port Arthur		X
Southern Acid & Sulphur Co.	Port Arthur		X
Sugarland Mfg. Co.	Sugarland	X	
Texas Chemical Co.	Fort Worth		X
	Houston		X
United Chemical Co.	Dallas	X	
	Forth Worth		X
Utah—Total		1	1
Garfield Chemical Co.	Garfield	X	
Hercules Powder Co.	Bacchus		X
Virginia—Total		8	1
American Agricultural Chemical Co.	Alexandria	X	
General Chemical Co.	Pulaski		X
Richmond Guano Co.	Richmond	X	
Robertson Chemical Corp.	Norfolk	X	
Royster Guano Co., F. S.	Norfolk	X	
Virginia-Carolina Chemical Co.	Lynchburg	X	
	Pinners Point	X	
	Portsmouth	X	
	Richmond	X	
Washington			
du Pont de Nemours & Co., E. I.	du Pont	X	X
West Virginia—Total		2	
Fairmont Chemical Co.	Fairmont	X	
United Zinc Smelting Corp.	Moundsville	X	
Wisconsin—Total		1	3
du Pont de Nemours & Co., E. I.	Barksdale	X	X
National Zinc Ore Separating Co.	Cuba City		X
New Jersey Zinc Co.	Mineral Point		X

H_2SO_4

Has Peak Production

PRODUCTION of sulphuric acid in 1929, according to *Chem. & Met.'s* annual estimate given on page 4 of this issue, was not only at the highest point since the War but was actually higher by over 6 per cent than the biggest war year, 1918. The total, estimated at 7,925,000 tons on a 50-deg. Bé. basis, represents very nearly 10 per cent more than the 1928 production. Of this, approximately 3,000,000 tons, also reduced to a 50-deg. basis, is believed to have been made in contact plants, a probable increase of from 30 per cent in 1928 to 35 per cent of the total production.

Every principal consuming industry showed a marked advance in sulphuric acid demand, from the smallest of 2.6 per cent for fertilizers to the largest of 38 per cent for rayon. The largest net increase occurred in the petroleum industry, where 220,000 tons is the addition in estimate for 1929 over the preceding year. This is followed by iron and steel, with 100,000 tons additional; coal products and chemicals, with increases of 80,000 and 75,000 tons, respectively.

Consumption of brimstone for the year in production of sulphuric acid has been estimated at 1,135,000 tons, equivalent to 5,606,000 tons of 50-deg. Bé. sulphuric acid. Pyrites consumption for the same purpose is estimated at 331,200 tons, producing 1,635,000 tons of acid, also on a 50-deg. basis. The difference between this total of 7,241,900 tons and the estimated total production from all sources, 7,925,000 tons, is represented by byproduct acid, 683,100 tons. The relative percentages are: 70.8 per cent from brimstone, 20.6 per cent from pyrites, and 8.6 per cent from other sources, chiefly zinc and copper refining. The increase in pyrites consumption is approximately proportional to the rise in acid production, suggesting that the use of pyrites is not more general than it was in 1928.

Sulphur

Record Year For the Industry

By RAYMOND F. BACON
Chemical Engineer, New York

APPARENTLY 1929 was a record year for the sulphur industry of the United States. Estimated total shipments amounted to 2,350,000 gross tons, representing an increase of about 13 per cent as compared with the 2,082,924 tons shipped in 1928. This increase is evidence of greater industrial activity throughout the world, as shipments both to domestic consumers and to foreign countries were appreciably larger than in the preceding year. Total exports probably will be in excess of 800,000 tons, an increase of about 115,000 tons over the 685,000 tons reported for 1928 by the U. S. Department of Commerce. Shipments in 1928 to domestic consumers totaled 1,396,000 tons, whereas those in 1929 amounted to about 1,550,000 tons. Production for the year is estimated at 2,400,000 tons, an increase of about 420,000 tons over 1928. Part of this increased production supplied the greater demand for shipments, and the balance went into stocks.

The Texas Gulf Sulphur Company began operations at its new property, Boling Dome, at Newgulf, Texas, the latter part of last March. The output, which was in excess of 300,000 tons, has all been put into storage, no shipments as yet having been made from that deposit. The company's plant at Gulf, Matagorda County, Texas, continued to operate without interruption. This company, according to reports, has obtained a third sulphur area at Long Point, Texas, which it is now developing. The discovery of these two new sulphur domes greatly increases the sulphur reserves of the country and assures an ample supply for the world market for many years.

Freeport Sulphur Company operated its deposits at Bryan Heights, Texas, and at Hoskins Mound, Texas, continuously throughout the year at a satisfactory rate of production.

The Texas Gulf Sulphur Company and the Freeport Sulphur Company continue to be chief factors in the industry, producing 97 to 98 per cent of the output of the United States.

The Duval Texas Sulphur Company started production late in October, 1928, and, according to reports, installed a second battery of boilers in August, 1929, that greatly increased its plant operating capacity. Tax reports of Texas show a production of approximately 35,000 tons of sulphur in the eleven months ended Sept. 30, 1929. A reasonable assumption, based on these figures, is that the production in 1929 was about 40,000 or 45,000 tons.

Exploration carried on in the Gulf coast region by the sulphur companies and the oil companies throughout the year failed to disclose any additional deposits of commercial sulphur.

Pyrites imports in 1929 are estimated at 480,000 tons, or about the same as in 1928. Domestic producers of pyrites continued to operate throughout 1929, and the final figures for pyrites production are expected to show an output of about 200,000 tons, representing but little change from the preceding year.

Busines institutions throughout the country are forecasting a normal year for 1930. The year 1929 may possibly have been a peak year for the sulphur industry, but, in view of the yearly growth of that industry, normal sales and shipments have moved probably onto a higher plane. If so, a total production of about 2,300,000 tons for the next few years may be expected instead of about 2,000,000 tons, as in several recent years.

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Acetic Acid Finds Larger Consuming Outlets

EXPANSION in the industries which are consumers of acetic acid has had a marked influence upon production of the acid. While the quantities passing to certain branches of the textile industry have shown some contraction in recent years, the increase in consuming outlets in other directions has more than offset this loss. Owing to diversion into other fields, difficulty was found at times last year in securing raw materials for acetic acid manufacture and this tended to cut down the rate of growth in acid production below the level which consuming demand warranted.

In 1927, domestic production of acetic acid was entirely from acetate of lime made in the wood distillation industry. In the latter part of 1928, production of synthetic acetate acid was started at Niagara Falls, and this gained headway last year with the promise of a much larger output in the coming year.

According to census figures, domestic production of acetic acid in 1927 and 1925 was as follows:

	No. of Establishments	For Sale — Lb.	For Sale — Value	Made and Consumed — Lb.
1925	16			
Dilute		28,722,303	$775,668	1,102,650
Glacial and anhydride		36,869,250	3,661,954	239,711
1927	17			
Dilute		46,228,162	2,327,085	10,762,097
Glacial and anhydride		30,203,843	3,196,667	8,739,603

Imports of acetic acid have more than tripled since 1927. For the 11 months ended Nov. 30, arrivals were reported at 27,937,757 lb. valued at $2,026,426. By far the greater part of imports was classified as not more than 65 per cent acetic acid.

Chromic Acid

Increase in Production

By JAMES J. KERRIGAN
Vice-President, Merck & Co.

ALTHOUGH the increase in the production and use of chromic acid in the electroplating and allied industries has been very pronounced over the last five or six years, the extent of its use in the first six months of 1929 almost equaled the whole of 1928 as regards production, sale and consumption for the purposes mentioned.

It is stated that somewhat over 2,000 different articles of manufacture are now being chromium plated. This is indicative of the scope of the use of the material. Generally speaking, chromium plating has two purposes, decorative and preservative. Plating for decorative purposes is an every day occurrence and has it largest utilization in the automotive industry, although it has other and almost unlimited possibilities in the plating of household utensils, fixtures and decorations. As a preservative, its chief function is in the production of a non-corrosive, non-rusting surface and as such is used in the plating of dies, metal working tools, printing surfaces, bearing surfaces in machinery, etc.

While the chromium plating process is said to be not a difficult one it must nevertheless, it appears, be carefully carried out and the conditions under which the work is undertaken must conform very closely to given standards. Difficulties are being encountered in some quarters of effecting an entirely satisfactory plating. With this possible trend it would seem that continued experimental and development work toward a simple and satisfactory method of application will further increase the popularity of chromium plating, not so much from the standpoint of its decorative value as from the standpoint of the place it has made for itself in the production of tools and implements and essential, though not decorative, parts of machinery, equipment, household utensils and fixtures, and similar other requisites.

Prior to 1927, domestic production of chromic acid was not given separately in the returns of the Census of Manufactures. By 1927 the output had become important enough to receive classification. For that year the census figures show 6 establishments with a total production of 898,093 lb. valued at $241,965. The census figures for 1929 will show a big gain over these totals.

Alkalis

Consumption Trend Upward

ALKALIS as a whole constitute one of the most important groups of the chemical industry and may be regarded as indicative of the trend of the heavy chemical industry. They may be divided into three classes, which together with the installed capacity at the close of 1929 are shown in the following tabulation on a comparable basis of 58 per cent soda ash:

	Short Tons, 58 Per Cent Soda Ash
Ammonia-soda plants	2,500,000
Electrolytic plants	398,000
Natural soda plants	90,000
Total	2,988,000

It will be seen that the total potential capacity of all alkali plants in the United States is in the neighborhood of 3,000,000 short tons of 58 per cent soda ash. At present-day costs of ammonia-soda plant for soda ash, this capacity would represent an investment of about $100,000,000. Including additional equipment for making caustic soda, sodium bicarbonate and modified sodas, the total investment would well exceed this figure.

The installed capacity of commercial plants for making caustic soda in the United States is about 770,000 short tons per year. This is made up of 470,000 tons for lime-soda plants and 300,000 tons for electrolytic plants. The lime-soda caustic is mostly produced at ammonia-soda plants, although there is a small quantity made from natural soda. In addition considerable soda ash is causticized at consuming plants in the soap, paper and other industries. The commercial lime-soda plant capacity would require about 635,000 short tons of soda ash as raw material.

Ammonia-Soda Industry—The ammonia-soda process may be regarded as the backbone of the alkali industry, as it accounts for 80 per cent of the total installed alkali capacity. The industry is represented by six plants in active operation which are owned by five companies. (See map, page 5.) All of these plants are located "on top" of salt deposits, so that the salt is mined by the cheapest method; i.e., in the form of brine. Other important factors in determining an economical location for an ammonia-soda plant are supplies of limestone and fuel and facilities for waste disposal.

The trend of the output of the ammonia-soda industry is shown in the accompanying chart which shows the production for sale of the three principal products—soda ash, caustic soda and bicarbonate of soda—on a uniform basis of 58 per cent soda ash from 1919 to 1929. Since 1923 it will be observed that the industry has expanded at a fairly uniform rate. The rate of growth has amounted to about 4 per cent per year.

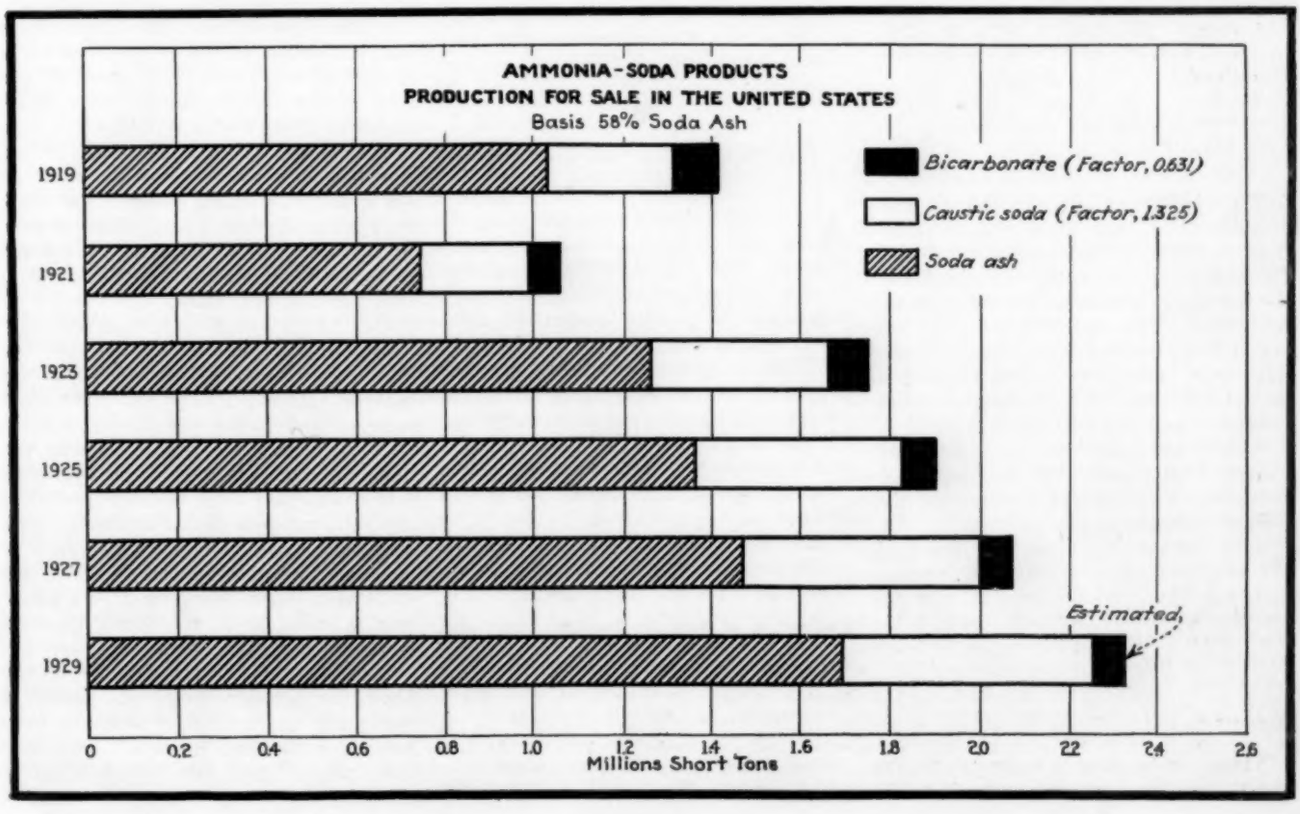
Electrolytic Alkali—The production of electrolytic alkali is dependent entirely on the amount of chlorine produced as a joint product which can be marketed. It therefore bears little relation to the market for caustic soda which far exceeds the chlorine market. In recent years the electrolytic process has accounted for about 30 per cent of the total caustic soda production, the greater part has been made from soda ash by the lime-soda process. The production of caustic by processes is shown in the accompanying table:

Production of Caustic Soda in the United States, 1921–1929

(Short Tons)

	Lime-Soda	Electrolytic	Total
1921	163,044	75,547	238,591
1923	314,195	122,424	436,619
1925	355,783	141,478	497,261
1927	416,473	167,500	583,973
1929 (estimated)	430,000	232,500	662,500

The capacity of electrolytic plants has increased from about 250,000 short tons per year immediately following the World War to about 300,000 tons at



the close of 1929, an increase of 20 per cent. This increase has resulted from expanded uses for chlorine. This increase has been almost entirely in commercial installations, as those at pulp and paper mills have remained practically constant at about 50,000 tons per year.

Natural Soda—The production of natural alkalis comes entirely from the brines of Searles and Owen Lakes of California. The output of natural sodas at the present time is a small part of the domestic consumption and is used by local industries on the Pacific Coast. A considerable portion is converted by the lime-soda process into caustic soda and in the manufacture of sodium silicate. The output in recent years has been as follows:

Year	Short Tons	Value
1927	67,240	$1,253,352
1928	79,830	1,578,256

Consumption Trends—The trend in consumption of the two most important alkalis, soda ash and caustic soda, are shown in the tabulation on page 5. The consumption of soda ash was 12.6 per cent greater in 1929 than in 1928 and caustic soda increased by 10.8 per cent. The increase in both of these products was greater than the normal growth which from 1923 to 1927 has been 4.4 per cent per year for soda ash and 8.7 per cent per year for caustic soda. There are no indications that this abnormal growth in alkali consumption will continue throughout the coming year.

The outstanding increases in the use of soda ash in 1929 as compared with 1928 have occurred in the following industries:

	Per Cent Increase
Chemicals	48.8
Exports	33.3
Petroleum refining	13.0
Pulp and paper	10.0
Glass	8.3

The industries listed above used 185,000 short tons more soda in 1929 than in 1928. The increase in the chemical industry is accounted for chiefly by the initial production of synthetic nitrate of soda at Hopewell, Va., and by increased requirements for sodium silicate. The only industries which showed a decrease in soda ash consumption were cleansers and water softeners.

A similar study of the figures for caustic soda shows that the important increases in consumption were in the following industries:

	Per Cent Increase
Rayon	28.0
Petroleum	18.4
Rubber reclaiming	14.3
Pulp and paper	12.1
Chemicals	9.1
Soap	6.2
Exports	5.1

These industries consumed 66,500 short tons more caustic soda in 1929 than in 1928. The decline in consumption of caustic soda was in that used for lye.

Market prices for caustic soda and soda ash have been fairly well stabilized in the last few years. Competition, especially in caustic soda, has been keen and this has led to some price cutting in the case of desirable contracts, but in the main there has been a steady price tone. The current contract price of light soda ash 58 per cent, in bags, is $1.32 per 100 lb. Caustic soda, solid 76 per cent in drums, is quoted at $2.90 per 100 lb.

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True Hypochlorites Appear For First Time in 1929

TRUE hypochlorites became available for the first time on a large commercial scale in 1929 through the marketing of high-test calcium hypochlorite under the trade name H T H by the Mathieson Alkali Works. Through the use of this material with soda ash, commercial solutions of sodium hypochlorite also were readily available for a variety of paper and textile bleaching, sterilizing, and cleansing applications. Formerly this type of operation was done either with solutions made from liquid chlorine or with bleaching powder.

Careful research has demonstrated that bleaching powder, commonly looked upon as modified hypochlorite, is really not chemically properly so classified, although on treatment with water it does form some hypochlorite in solution. The new material available for the first time during 1929 gives much more concentrated hypochlorite; it has been found applicable in certain operations not as conveniently done with either bleaching powder or liquid chlorine.

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Gains in Sulphur Dioxide Production

ACCORDING to data collected at the biennial census of manufacturers taken in 1928, 10,133,983 lb. of sulphur dioxide, valued at $687,855, was produced in 1927. This output, as compared with 8,861,341 lb., valued at $635,738, produced in 1925, the last preceding census year, represents increases of 14.3 per cent in quantity and 8.2 per cent in value. This production was reported by 4 establishments—2 in New Jersey, 1 in Virginia, and 1 in Wisconsin.

The following statement shows the production of sulphur dioxide as reported for the last three census years:

Production of Sulphur Dioxide 1927, 1925, and 1923

	1927 *	1925 *	1923 †
Number of establishments	4	3	3
Pounds	10,133,983	8,861,341	6,575,995
Value	$687,855	$635,738	$414,049

* New Jersey, 2; Virginia, 1; Wisconsin, 1.
† California, 1; New Jersey, 1; Virginia, 1; Wisconsin 1.

Liquid Chlorine Lowered In Price

WHILE consuming demand for liquid chlorine was of a progressive nature last year, the domestic output was increased in at least a corresponding degree and stocks were ample at all times. For the last five years there has been a pronounced trend toward a larger use of liquid chlorine and a corresponding contraction in demand for bleaching powder. This trend was in evidence last year, and while official figures for production in 1929 are not yet available, it is estimated that domestic manufacturers turned out in the neighborhood of 160,000 tons of liquid chlorine, whereas bleaching powder production had declined to around 100,000 tons.

Production of liquid chlorine and bleaching powder, as given in the census returns for the last three census years, offer the following comparisons:

	1927	1925	1923
Chlorine			
Number of establishments	15	14	12
Production, lb.	234,978,522	166,325,643	125,361,020
Made and consumed, lb.	54,815,084	61,365,457	49,242,780
For sale, lb.	180,163,438	104,960,186	76,118,240
New York, lb.	98,458,333	71,520,183	62,310,788
Other states, lb	81,705,105	33,440,003	13,807,452
Value	$6,678,145	$4,256,307	$2,778,088
Calcium hypochlorite.			
Number of establishments	19	17	16
Production, tons	111,524	115,438	146,975
New York, tons	29,211	50,527	72,760
Other states, tons	82,313	64,911	74,215
Value	$4,148,205	$3,964,604	$5,192,385

These figures not only accentuate the rising trend of chlorine production at the expense of bleaching powder but also illustrate the fact that New York has lost some of its importance as a producing state. In 1923, about 82 per cent of the liquid chlorine sold, originated in New York; in 1925, less than 70 per cent; and in 1927, about 55 per cent. A similar condition is found in the case of bleaching powder. In 1923, approximately one-half of total production rested in New York with not much more than one-quarter of 1927 production made in that state.

One of the most important developments of the year in the market for liquid chlorine was the lowering in the contract prices. Deliveries over 1929 were quoted at 3c. per pound, but for 1930 deliveries the quotation was put down to 2¾c. per pound, and even this figure was said to have been shaded in the keen competition for business which developed. The sales schedule for bleaching powder quoted contracts for 1929 at 2c. per pound, and this figure was renewed so as to include contract commitments over 1930.

One of the adverse factors in the bleaching powder trade was found in the sharp falling off in demand from foreign consuming centers. This was particularly true of shipments to Canada.

Borax

Marked Increase In Consumption

By PAUL D. V. MANNING
Assistant Editor, Chem. & Met.
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CHARACTERIZED by the largest annual production in its colorful history, the borax industry during 1929 witnessed a further decline of price in the early months of the year, which was followed near the close of the year by a stiffening market, pointing to a general increase for 1930.

The past year was clearly a consumers' year. With producing companies fighting for business at continually lowering prices, users of borax increased both in numbers and quantities used. Marked increase in borax consumption was noted in the enamel industry. In many smaller industries wherein a mild alkali is required, borax is being found very satisfactory and is replacing other forms of alkali in increasing amounts.

By far the greatest increase in use, however, took place in the manufacture of glass. As is well known, borax has been used for many years in the manufacture of higher priced glass, notably those which are heat resisting. Two years ago the American Potash & Chemical Corporation, with the co-operation of one of the large glass producers, began an extensive research program, results of which have shown that the addition of borax to raw materials betters the melting, reduces manufacturing difficulties, and gives altogether a superior product improved in strength, life and appearance.

This research has been placed at the disposal of the glass manufactuers, with the result that this industry used a considerable part of the total tonnage of borax during 1929, an amount which will certainly increase markedly in 1930. Further research along other lines by this company as well as the Pacific Coast Borax Company should develop new uses in other industries in 1930, with a corresponding increase in consumption. The attitude taken by the large producers is one which is very helpful in popularizing borax as a raw material for the process industries, and is not only saving the latter much money but is lessening the usual time lag found between cheap production and increased use.

Practically all of the borax produced came from two districts in California. These areas are in reality very close together but production is from different sources.

In the Kramer district in Kern County, three operators produced an approximate total of 103,200 tons of borate minerals (in terms of refined decahydrate). This production is by mining the quadrihydrate mineral, rasorite. Most of that produced by the Pacific Coast Borax Company (Borax Consolidated, Ltd.) in this district was shipped to its Wilmington, Calif., plant for refining. The larger part of that produced by the Western Borax Company was exported without refining. The Pacific Coast Borax Company produced more than half of the total United States tonnage of borax.

At Searles Lake, Calif., where production is entirely from brines, three plants produced an approximate total of 55,900 tons as refined decahydrate. Almost all of this was from the plant of the American Potash & Chemical Corporation, and this figure includes about 6,000 tons of boric acid made by the same company.

PRODUCTION in all other districts in the United States amounted to about 300 tons (as refined decahydrate) bringing the total domestic output for 1929 to approximately 159,400 tons. Over half of this total was exported to Europe. In the early part of the year, a small quantity of borate mineral was produced in Asia Minor and South America, but production was shortly discontinued.

Colemanite and ulexite deposits have remained relatively untouched, about 100 tons being mined during the year. Experimental work undertaken several years ago in an effort to attain new direct uses for these minerals is still in progress but as yet has been unsuccessful. Investigators looking for problems might well consider this one, for its solution would pay immediately and well.

Crude ores from the Kramer district (rasorite and tincal) are being experimentally used in flotation work.

Improvements in equipment and technology were made by most of the California concerns. The plants of the American Borax Company at Rochester, Pa., and Chauncey, N. Y., were closed.

Published prices ranged from $50 to $65 per ton delivered in New York. Some of the actual prices paid on contract sales and an occasional "spot" ran as low as $35 to $40 per ton. This would net the producer about $15 to $20 at the refining plants, which is too low to permit much, if any, manufacturing profit. This condition is unsatisfactory for both consumer and producer, and the "actual" price at the beginning of 1930 had risen to about the published figure, where it is likely to remain for some months. While it is not unlikely that the price will tend to fluctuate between the present and a figure somewhat lower, it is probable that it will never even approach the high figure of several years ago, but will remain stabilized at a point somewhere near the present figure.

Exports of borax in 1928 amounted to 135,702,837 lb. which surpassed the total for any preceding year. For the first 11 months of 1929, exports were 144,260,038 lb. and outward shipments for the year therefore will be the largest in the history of the trade. The lower prices which prevailed for borax shows up sharply in the valuation of exports, as the average price for 1928 was slightly less than 2.55c. per pound while in 1929 the average dropped to less than 1.83c. per pound.

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Creosote Oil Finds Large Consuming Market

CREOSOTE or dead oil was in active demand throughout the year, and judged on a quantity basis, takes a high place among chemical manufactures. Within the last ten years domestic consumption has increased fourfold. In fact, consuming demands have far outstripped those reported for the manufacturing branch of the industry. As a result of this condition it has been found necessary to call upon foreign sources of supply in order to round out domestic requirements. Last year, the home output was increased, and further increases are anticipated for the future. It is still necessary, however, to make use of foreign-made material, and imports last year, while less than in 1928, formed a large part of the total available supply.

Reports to the Tariff Commission credited a domestic production of creosote oil in 1928 of 134,460,126 gal., which with importations of 88,385,074 gal. gave a total supply of 222,845,200 gal., which may be regarded as representative of domestic consumption. In 1928, reports to the Forest Service indicated that 220,478,400 gal. of creosote oil was used in the treating plants of the wood-preserving industry. Creosote oil also is used in making disinfectants and animal dips, and as a raw material for producing other coal-tar products.

Imports of creosote or dead oil for the first eleven months of last year were 75,325,963 gal., valued at $9,602,071. Imports in 1928 and 1927 were 88,385,074 gal. and 95,915,221 gal., respectively. Great Britain is the largest shipper of creosote oil to this country, and of 1929 imports more than 50 per cent were of British origin.

Salt Cake

Byproduct Manufacture On Declining Scale

By GUY A. GARDNER
Manager, Chemical Division M. Gottesman & Company, Inc.

CRUDE sodium sulphate, or salt cake, as it is generally known in the trade, is one of the basic raw materials for several important industries. Large quantities are used in the manufacture of woodpulp and in the manufacture of plate and window glass. It is also a starting point for the manufacture of other sodium salts such as glaubers salts, sodium sulphide, etc.

Salt cake is obtained as a byproduct from the manufacture of hydrochloric acid and this has been the main source of supply. The figures from the last Census of Manufactures show that approximately 200,000 tons was produced during 1927 in the United States by this method. The production of salt cake is also supplemented by the use of nitre cake (bisulphate of soda) in the hydrochloric acid process by many manufacturers. For many years the production of salt cake and nitre cake as byproducts was considerably in excess of the normal requirements of the industries, and being byproducts, were readily obtainable by consumers at very low prices. In the last few years, however, this condition had radically changed, due to the constantly increasing demand for salt cake from the various industries and to a considerably lessened production by the acid manufacturers. Most of our nitric acid is now made from synthetic ammonia, with the result that nitre cake as a byproduct is produced only by the relatively few plants using the old process. The lack of nitre cake has also considerably curtailed the production of salt cake. Some manufacturers who were using nitre cake in their process turned to the sulphate when they could not obtain the bisulphate, thus again increasing the demand for salt cake.

The production of sulphate woodpulp in the United States has grown rapidly in the last few years, having increased from approximately 188,000 tons in 1920 to nearly 725,000 tons in 1928, and the American Pulp & Paper Association estimates that the 1929 production will be in the neighborhood of 1,000,000 tons. These figures will serve to indicate the increase in the use of salt cake by the woodpulp industry alone. This growing demand has resulted in the increased importation of salt cake from foreign countries, but the change in the process of manufacturing nitric and hydrochloric acids is taking place in all the great chemical producing countries of Europe as well as in the United States, so that the curtailment of production of byproduct salt cake and nitre cake is practically world-wide. If the consumption of salt lake continues to increase during the next few years at the same rate as it has in the past, it would seem that a really serious shortage of this essential chemical will develop unless some cheap and dependable method of obtaining it is found in the very near future.

SULPHATE of soda is also found in natural deposits in various parts of the United States and Canada, but of the deposits so far discovered, only a few are capable of producing except at a prohibitive cost and most of them are located at distant and inaccessible points, where the question of freight charges to consuming centers makes it almost impossible to develop them profitably. Some of these deposits, however, have been worked with more or less success, and according to United States Government statistics, there were 23,080 short tons of this natural sulphate of soda produced in 1927.

The importance to American industry of a constant supply of salt cake at a moderate price can hardly be overestimated and, realizing this condition, considerable effort and money have been expended in the last few years to develop such a supply. There is every reason to believe that some of these efforts will meet with success, and it is to be hoped that the market for salt cake can be stabilized to prevent the constant price increases that have developed in the last year or two. It must be borne in mind that the woodpulp and window glass industries have to meet competition from foreign producers and, due to this competition, the prices of woodpulp and of window glass have been constantly decreasing in the last few years. It is therefore of paramount importance that they secure their raw material on a reasonable basis, and an adequate supply of salt cake is necessary for the continued progress and success of their business.

Sodium Sulphate Plant For Saskatchewan

In the latter part of the year reports were received from the U. S. trade commissioner at Winnipeg to the effect that an important sodium sulphate development was planned for south central Saskatchewan near Ormiston, or about 60 miles south of Moose Jaw. An American chemical corporation was said to have secured 6 sections of land estimated to contain at least 9,000,000 tons of sodium sulphate. Production was planned for the early part of 1930.

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Imports of Salt Cake on Increasing Scale

IMPORTS of salt cake into the United States for the first 10 months of 1929 reached a total of 81,616 tons, which approaches three times the total imports of 1923, of 28,228 tons, and is at the rate of close to 100,000 tons for the entire year. This reflects the continued growth in recent years in American imports of this commodity, from a figure of 1,913 tons in 1925 and 11,171 tons in 1927 to 75,426 tons for the nine months of this year. It is estimated that in 1927 the United States imports of German salt cake represented about 8 per cent of Germany's total exports, 20 per cent in 1928, and present figures indicate approximately 45 per cent for 1929. Imported salt cake is used not only in plants close to the Atlantic seaboard but also is reported to have been shipped in large amounts from foreign ports direct to Pacific coast ports.

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Sales and Distribution of Lime in 1928

THE LIME sold by producers in the United States in 1928 amounted to 4,458,412 short tons, valued at $36,449,635, according to figures obtained from a compilation of reports made by lime manufacturers to the Bureau of Mines, in co-operation with the Geological Surveys of producing states. This represents an increase of about 1 per cent in quantity and a decrease of 6 per cent in value as compared with 1927.

Sales of lime used in the manufacture of chemicals—2,138,037 tons, valued at $16,455,657—increased 10 per cent in quantity; lime sold for construction—1,986,465 tons, valued at $17,706,420—decreased 7.5 per cent in quantity; and that sold for agricultural purposes—333,910 tons, valued at $2,287,558—increased 3 per cent in quantity.

Silicate of Soda Gains in Export Trade

DOMESTIC consumers of silicate of soda were active last year and as buying for export was the largest on record, domestic production was estimated to have surpassed the totals for preceding years. In addition to the old outlets, new uses for silicate have been developed and this has aided in putting this chemical on a higher relative plane in the list of chemical manufactures.

Census compilations show domestic production of silicate of soda, on a basis of 40 deg. for the last three census years as follows:

	1927	1925	1923
Number of establishments..	24	23	21
Production tons	504,518	394,884	331,309
Value.....	$6,826,099	$5,717,426	$5,066,719

Gains in the distribution of silicate of soda were reported for 1928 and further extension marked the trade of last year, so that the present rate of production is considerably above that reported for the last census year. The manufacture of corrugated fiber and wall board, soap, box sealing and other adhesives, continued to offer the largest outlets for silicate, with a wide variety of miscellaneous uses accounting for an appreciable quantity.

Export shipments have steadily grown in volume and at present are estimated to approximate 30 per cent of total production. By far the greater part of exports are sent to Canada. Since 1924, Canada has more than doubled its importations from the United States, the totals being 28,280,000 lb. in 1924 and 54,595,000 in 1928.

The larger part of silicate of soda production is distributed in water solutions, with the strength varying according to the requirements of consumers. Silicate also is marketed in solid form, as lumps, and in powder form. The industry is rather widespread, with nearness to consuming markets an important factor in plant location.

Prices for silicate of soda vary according to the different grades, quantities involved, and the competitive state of the market. For the greater part of last year, the open quotation for 40 deg. Bé. silicate was 75c. per 100 lb., but this later gave way to an asking price of 70c. for 100 lb.

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Caustic Potash Affected By Foreign Offerings

IN Recent years caustic potash of foreign origin has been an important factor in domestic markets and has supplied the greater part of domestic consuming requirements. This has naturally acted as a check on expansion of home manufacture. Consumption of caustic potash in this country has broadened, but importations have increased accordingly, and the larger outlets have failed to react in favor of domestic producers. Figures showing domestic production are not included in the census compilations, but as total consuming requirements of this country are estimated as approximating 8,000 tons, it is evident, from the volume of imports, that the home output is relatively small.

Imports of caustic potash in the first eleven months of last year were 13,890,600 lb., valued at $913,178.

Export Classifications Undergo Change

Several changes have been made by the Commerce Department in the statistical classification of chemical exports, effective with January, 1930. In the coal-tar group specific provision has been made for reporting exports of laminated synthetic resin sheets and plates and other synthetic resin products. Under medicinal and pharmaceutical preparations, biologics for human use will be reported in two classifications, one covering serums and antitoxins and the other, vaccines. The attempt to classify medicinal preparations according to internal and external use has been dropped. No changes have been made in the schedules on industrial chemical specialties, pigments, paints and varnishes, fertilizers or explosives. In the industrial chemical classification, ethers and esters will be reported as such. Several new classifications have been introduced into the schedule covering soap and toilet preparations.

Export Association Formed For Carbon Black

ONE OF the most important developments of the year in the market for carbon black consisted in the formation in the latter part of the year of an export association. This association was reported to include companies producing more than 92 per cent of the world output of this commodity. The purpose of the association is to promote the rapidly growing interests of American carbon black manufacturers in foreign markets. The principal foreign buyers of carbon black are Canada, England, France, and other European countries, but the distribution is practically world wide.

The importance of foreign trade in carbon black may be inferred from the statistics of exports, which show that for the first eleven months of last year, 83,271,858 lb. valued at $7,403,370 was shipped out of the country. Total exports in 1928 amounted to 77,903,153 lb. valued at $6,794,224, and in 1927, 54,430,811 lb. valued at $4,599,734. These figures point to a steadily broadening market abroad and emphasize the importance of this branch of the industry.

The rapid increase in the rate of automobile tire manufacture in this country is sufficient evidence of the enlargement last year in home demand for carbon black. Domestic production, therefore, was increased during the year, and while definite figures are lacking, a new record for production undoubtedly was established. Acording to reports from the U. S. Bureau of Mines, production of carbon black in 1927 was 198,429,000 lb., as against 177,417,378 lb. in 1925, and 138,262,648 lb. in 1923.

Chemical Products, Value, by Industries and by Chemical Groups 1921 to 1927

Industry or Chemical Group	1927	1925	1923	1921
Industries				
1. The chemical industries, all products, total value	$572,090,732	$570,310,106	[1]$655,274,829	[1]$412,231,354
2. "Chemicals, not elsewhere classified" industry	548,535,935	547,003,093	630,870,249	390,768,434
3. "Sulphuric, nitric, and mixed acids" industry	23,554,797	23,307,013	24,404,580	21,462,920
4. Chemicals	533,592,538	544,651,190	634,432,927	401,022,875
5. Other products (not normally belonging to the industries)	38,498,194	25,658,916	20,841,902	11,208,479
6. Chemicals made as secondary products in other industries	83,228,766	66,661,789	53,097,421	42,142,506
Chemicals, all industries:				
Aggregate value (sum of 4 and 6)	616,821,304	611,312,979	[1]687,530,348	1443,165,441
Intergroup duplication	21,858,311	49,398,206	34,063,243	38,335,693
Gross total	638,679,615	660,711,185	721,593,591	481,501,134
Chemical Groups				
I.—Acids	88,175,519	79,273,578	79,005,511	59,538,275
II.—Nitrogen and fixed-nitrogen compounds	26,085,661	29,659,414	30,435,909	21,059,976
III.—Sodium compounds	113,880,497	109,522,017	111,848,381	83,698,199
IV.—Potassium compounds	9,306,037	6,071,146	6,318,822	4,934,749
V.—Alums and other aluminum compounds	13,563,095	11,581,290	11,066,611	23,243,824
VI.—Bleaching compounds	18,974,515	17,167,412	16,729,233	13,900,353
VII.—Coal-tar products	106,056,504	112,201,348	121,893,211	75,918,521
VIII.—Plastics[2]	[3]28,202,865	48,731,957	102,229,807	58,836,711
IX.—Chemicals, miscellaneous	234,434,922	190,970,407	188,682,077	99,949,691
Compressed and liquefied gases[4]	(5)	55,532,616	53,384,029	40,420,835

[1] Not strictly comparable with figures for 1927 and 1925; see footnotes 2, 3, and 4.
[2] Data for rayon are included for 1923 and 1921 but not for 1927 and 1925.
[3] Data for pyroxylin solutions excluded for 1927; see table 13, footnote 3.
[4] At former censuses "Compressed and liquefied gases" constituted Group IX and "Chemicals, miscellaneous," Group X.
[5] The manufacture of compressed and liquefied gases was treated as a separate industry at the census for 1927.

Solvents

Present and Future Demands

AN EDITORIAL STAFF INTERPRETATION

PYROXYLIN lacquers have now completed five years of remarkable growth during which they have increased more than tenfold in output and have extended their application to a wide range of markets. Is it possible, from a study of that growth, to predict the future development of the lacquer industry and, therefore, of the solvents which are consumed in it? Some such attempt has been made in the accompanying chart, in which the normal growth curves have been extended in accordance with the evident trends. Such a method has obvious disadvantages yet in the aggregate it perhaps gives a fair picture of possibilities and may well furnish a basis for subsequent discussion and interpretation.

Before considering the individual solvents in their relation to each other and to the total production, however, it is of interest to look at the present and prospective future markets for the lacquers in which solvents are used. The results of an impartial study recently completed by an independent agency are summarized in Table I.

Table I—Estimate of Future Demand for Lacquers

(Thousands of Gallons)

	Automotive	Furniture	Industrial	Brushing Lacquers	Railways	Interior Decorating	Misc.	Total Production Pyroxylin Lacquers
1924	.....	.....	.....	.....	.....	.....	.....	* 3,600
1925	.....	.....	.....	.....	.....	.....	.....	*11,100
1926	12,000	.....	.....	.....	.....	.....	.....	*23,000
1927	22,500	7,500	.....	.....	.....	.....	.....	*30,800
1928	25,000	8,000	4,000	2,000	200	1,800	2,000	43,000
1929	26,100	8,700	6,000	2,300	300	2,000	2,500	47,900
1930	26,600	9,500	7,700	2,600	400	2,400	3,100	52,300
1931	27,800	10,200	8,800	3,000	500	2,700	3,800	56,800
1932	28,500	11,000	10,600	3,500	600	3,100	4,800	62,100
1933	28,800	12,000	12,000	4,000	700	3,600	6,000	67,100

*Department of Commerce.

From this it will be observed that the total lacquer production, which the Department of Commerce last reported as 30,800,000 gal. in 1927, is estimated to have increased to approximately 48,000,000 gal. in 1929, with a projected future development to 67,000,000 in 1933.

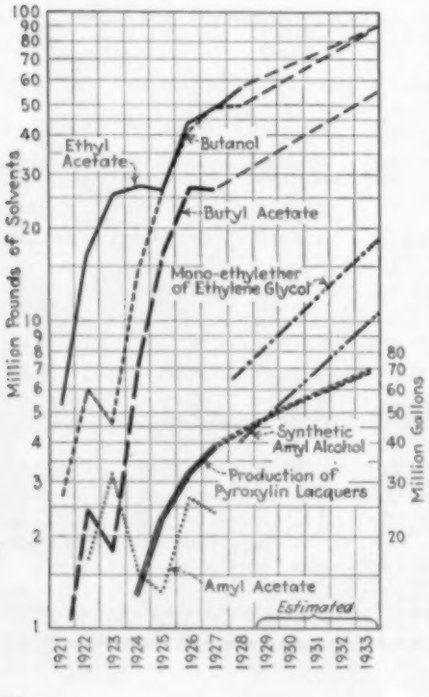
The automobile industry, which in 1928 is estimated to have accounted for about 60 per cent of the total market, is expected to become of relatively lesser importance, although even after five years it will probably be more than twice the size of any other single market. Next in volume perhaps will be the industrial market; i.e., the use of lacquers in finishing machinery, such as typewriters and electrical refrigerators. The demands of the furniture industry are also likely to increase at a more rapid rate than those of the automobile field. Brushing lacquers, the railways and interior decorating are all markets that are likely to become relatively more important.

Ethyl Acetate—One of the oldest and still one of the most important lacquer solvents, ethyl acetate has occupied a unique position in the industry. Because it is the cheapest of the low-boiling solvents, its consumption has increased even more rapidly than that of lacquer itself—due, of course, to the growing demand for less expensive finished products. Only within the past few years has its volume of production been exceeded by any other solvent.

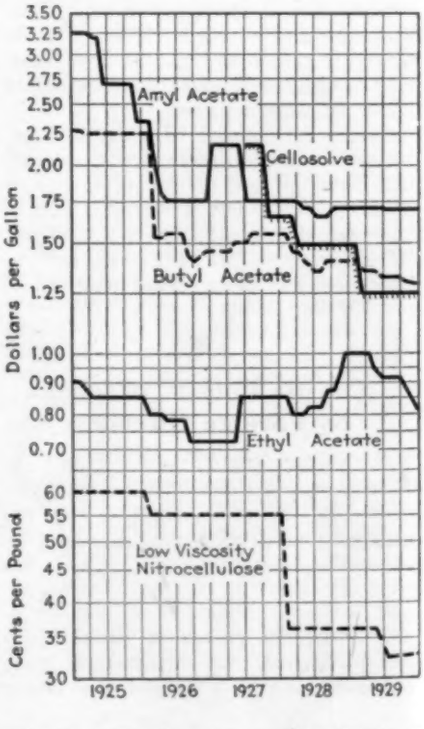
Ethyl acetate is largely used also in the manufacture of artificial leather—a use which in 1925 amounted to roughly 12,000,000 lb., or 44 per cent of the total production of that year. On the assumption that future production will more or less parallel that of lacquers, it is estimated that the 1933 demand will be in the neighborhood of 90,000,000 lb., in comparison with 58,000,000 lb. in 1928.

Butanol and Butyl Acetate — The rapid and steady increase in the production of butanol has been one of the romances of chemical industry. From less than 2,000,000 lb. in 1921 its output increased to over 50,000,000 lb. in

Production Trends in Solvents



Price Trends in Solvents



1928. The curves given graphically on page 58 show that production of both butanol and butyl acetate has grown at rates approximately paralleling the output of pyroxylin lacquers. If butanol is to maintain its present position of supremacy in the industry, it would be fair to assume that this parallelism would continue. On such a basis the production of butanol in 1933 would amount to 90,000,000 lb. If on the other hand, it is to be assumed that competing solvents may capture an increasingly larger share of the lacquer market, it is still reasonable to believe that the butanol output will grow to at least 70,000,000 lb.

Attention must also be given to the fact that fermentation butanol faces prospective competition, not only from other solvents but from synthetic butanol made from acetylene or in high-pressure synthesis. For some years German manufacturers have produced butyl acetate synthetically, shipped it across the Atlantic, paid a 25 per cent duty in the United States and sold as much as 750,000 lb. per month in competition with the domestic product. High-pressure synthesis, now rapidly developing in this country, offers at least a partial threat against the continued supremacy of the fermentation product in the lacquer and solvents markets.

Ethylene Derivatives — An equally remarkable development in recent years has been in the growth of solvents prepared from the gas, ethylene, which is produced in the cracking of gasoline and related hydrocarbons. Most important of the group at present from the standpoint of the lacquer solvents is the ethylene glycol mono-ethyl ether sold under the trade name of "Cellosolve." Its properties in many ways closely approximate the specifications for an ideal solvent. On the basis previously mentioned — viz., that competitive solvents are likely to take as much as 20,000,000 lb. of the future butanol market by 1933—it is believed that roughly two-thirds of this total will be captured by ethylene derivatives. This would make the conservative estimate of the 1933 output somewhere in the neighborhood of 19,000,000 lb. of the mono-ethyl ether of ethylene glycol.

Production of the principal ethylene derivatives is shown in Table II, prepared from one of the tariff briefs submitted before the Committee on Ways and Means in 1929. The same source is authority for the following quotations showing the continued decline in the market price per pound of ethylene glycol—the key commodity of the group.

1922	$1.00	1926	$0.40
1923	.75	1927	.30
1924	.65	1928	.27
1925	.50	1929	.25

Table II.—Production of the Principal Ethylene Derivatives
(Pounds)

Year	Ethylene Glycol	Ethylene Dichloride	Glycol Ethers
1922	10,000	.....	.....
1923	50,000	5,000	10,000
1924	144,562	9,464	38,890
1925	2,189,689	28,184	23,401
1926	5,714,823	74,439	1,341,331
1927	11,722,798	886,533	1,078,783

Source: Tariff brief of Carbide & Carbon Chemicals Corporation before Committee on Ways and Means, 1929.

Amyl Alcohol and Amyl Acetate — These solvents were the first to be used in lacquers. Doubtless their high prices in the early days and necessarily limited production (as a byproduct of alcohol fermentation) retarded the early growth of the lacquer industry. Now, with the synthesis of amyl alcohol from pentane, these compounds become potentially more important in the solvent situation. They are directly competitive with butanol and butyl acetate, with which they are closely akin chemically. Higher prices have been somewhat of a handicap in the past, but as the production of synthetic amyl alcohol is increased, production costs doubtless will be lowered somewhat and the use of the product expanded.

Assuming that the production of synthetic amyl alcohol was in the neighborhood of 4,000,000 lb. in 1928 and that it may take as much as 7,000,000 lb. of the future butanol market by 1933, the total production for that year should be about 11,000,000 lb.

It is recognized, of course, that these estimates of the possible future markets for solvents are not complete, and would be subject to considerable change in light of technical or economic developments that would affect the lacquer market itself or would unbalance the present relation existing between the various commodities. The information is cited, however, as a basis for further study as the situation develops.

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Butanol

Forges Ahead

BY WILLIAM MUELLER
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New York

THE YEAR 1929 was one in which the American chemical industry forged ahead at a remarkable rate. The branch of the industry concerned with solvents has been in the forefront of this advance. Throughout the year businesses of various sorts have operated at peak capacity, thus creating an enormous demand for solvents for use both in process and in the finishing of manufactured articles.

During this period the fermentation solvents, butanol, (n-butyl alcohol) and acetone C.P. have been in tremendous demand. Both these materials are widely used in the cellulose nitrate and cellulose acetate industries, and these basic industries were very quick to reflect the prevailing business activity.

Nitrocellulose lacquers, which contain butanol and butanol derivatives, heretofore used principally in the finishing of automobiles, are now enjoying wide use in many other fields. Linoleum, wood floors, toys and leather are now being lacquered as are tremendous quantities of wood and metal furniture. The use of lacquer for architectural purposes is gradually evidencing itself and this outlet for lacquers and, consequently, lacquer solvents promises to be large. Lacquer has been adopted for the finishing of railroad equipment, and it is not at all unlikely that eventually it will be the standard finish.

The growth in the celluloid industry is closely paralleling that of lacquer and is, therefore, absorbing large quantities of acetone and allied solvents. Probably the biggest single factor responsible for this rapid progress has been the adoption by most automobile manufacturers of the use of laminated glass—a sheet of celluloid compressed between two sheets of glass to produce a transparent nonshatterable product.

GROWTH of the cellulose acetate industry during the same period and the erection of several new plants for the manufacture of acetate silk, may be directly traced to the availability of pure acetone at relatively low cost.

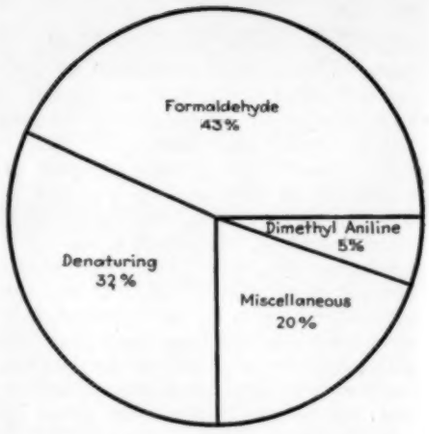
The derivative of butanol, dibutyl phthalate still enjoys wide use as a nitrocellulose and resin plasticizer and its manufacture and sale have kept pace with the increasing demands of the lacquer and synthetic resin manufacturers.

Acetone's principal derivative, diacetone alcohol supplies the market with

a solvent for both cellulose nitrate and cellulose acetate, and in addition has the desirable property of reducing the viscosities of alcohol-glycerine solutions particularly at low temperatures.

The manufacture of methanol from waste gases is being accomplished very successfully, and as a result good quantities of practically a chemically pure methyl alcohol have been made available for the manufacture of such materials as dimethyl aniline, methyl salicylate, formaldehyde, etc.

Although it is impossible at this time to definitely forecast the trend of business next year it is in line with conservatism to predict a greater use and consumption of solvents during the coming year than has ever been experienced before.



Estimated Distribution of Methanol by Industries

Methanol

Synthetic Output Up

IT has been reliably estimated that the United States consumes approximately 9,400,000 gallons of methanol each year. Of this quantity, about 4,000,000 gallons, or 43 per cent, is used in the manufacture of formaldehyde for use as a disinfectant and in the manufacture of synthetic resins. The denaturing of industrial alcohol requires 3,000,000 gallons annually, or 32 per cent of the total. Under the present regulations of the government, only the grade of methanol obtained by hardwood distillation is acceptable for this use. The product, dimethyl aniline, accounts for about 425,000 gallons, or 5 per cent of the total output. Miscellaneous uses, such as in solvents and in other forms of chemical substances, account for approximately 20 per cent.

The production of synthetic methanol in the United States during 1928 is estimated to have amounted to 2,132,000 gallons. In January, 1929, the National Wood Chemical Association in its brief to the Ways and Means Committee of Congress estimated that the 1929 production of synthetic methanol would amount to 3,000,000 gallons, distributed as follows:

	Gallons
Commercial Solvents	1,750,000
DuPont	1,000,000
Miscellaneous	250,000
Total	3,000,000

During the year, however, the industry developed at a much more rapid rate, and it is reliably estimated that instead of 3,000,000 gallons, the output for 1929 was actually in the neighborhood of 4,500,000 gallons. The estimated production from "miscellaneous sources" did not prove substantial during 1929, but both of the other sources indicated increased their output by a considerable amount.

It is further estimated that production of synthetic methanol in 1930 will proceed at the rate of approximately 7,000,000 gallons per year. In addition to the two producers referred to by the National Wood Chemical Association, the Union Carbide and Carbon Company is expected to contribute substantially to the total.

The production and stocks of crude and refined methanol in the United States and in Canada for eleven months of 1928 are compared with the corresponding months of 1929 in the accompanying tables.

Production, Shipments and Stocks of Methanol

United States

	Crude			Refined		
		Stocks, End of Month				
1929	Production, Gal.	At Crude Plants, Gal.	At Refineries and in Transit, Gal.	Production, Gal.	Shipments or Consumption, Gal.	Stocks, End of Month Gal.
January	700,613	235,052	145,093	494,501	506,624	503,054
February	685,567	227,515	153,423	449,800	466,621	550,702
March	725,662	275,361	147,531	494,435	518,906	681,815
April	746,007	186,036	172,755	502,010	568,118	695,180
May	743,632	234,660	262,082	423,244	472,360	716,762
June	676,193	227,513	277,376	423,811	449,245	759,740
July	633,731	252,749	475,698	259,118	365,438	712,752
August	656,414	244,185	526,172	454,160	487,153	783,674
September	598,548	256,356	514,572	432,094	598,551	729,932
October	716,789	251,704	521,967	445,183	558,179	725,620
November	.....	.....	.....	.....	.....	.....
Canada						
January	52,925	28,103	48,495	59,800	47,629	35,234
February	46,067	35,693	47,832	47,700	33,623	38,393
March	51,303	30,003	59,623	47,500	43,885	36,149
April	42,183	16,697	66,218	35,300	14,576	48,226
May	32,614	14,322	65,965	49,700	45,274	43,474
June	28,291	11,533	66,870	36,900	11,650	51,787
July	28,688	21,863	78,120	10,400	21,403	31,185
August	25,950	20,092	63,702	43,700	22,188	37,761
September	17,581	17,061	65,505	27,800	31,902	21,888
October	16,904	12,924	47,479	56,300	48,532	14,238
November	.....	.....	.....	.....	.....	.....

Ethyl Alcohol

Production Increases

ALTHOUGH not in itself an important lacquer solvent, ethyl alcohol nevertheless occupies a strategic position in the entire development. It is an essential raw material in the manufacture of such pyroxylin solvents as ethyl acetate, glycol ether, and ethylene lactate. Furthermore, the nitro-cellulose base always is shipped wet with 30 per cent of its weight of alcohol. It is of interest to note the recent trend in the production of industrial alcohol.

For the first time since 1926 the alcohol produced at industrial alcohol plants exceeded 200,000,000 proof gallons[1] during the fiscal year ended June 30, 1929. This is but 2,000,000 gallons less than the record output of 1926. Of the 200,832,051 proof gallons produced during the fiscal year, 182,778,966 proof gallons was withdrawn for denaturing. This quantity is compared with the withdrawals of previous years in the table on the following page.

[1] *Editor's Note*—The term "proof gallon" used by the government refers to the standard or "wine" gallon containing but 50 per cent of pure alcohol. Accordingly one wine gallon of absolute alcohol is equal to two proof gallons—or as commonly expressed, is "200 proof." The usual commercial alcohol of 95 per cent strength is "190 proof." Therefore, government figures in "proof gallons" can be converted to wine gallons of commercial alcohol merely by dividing by 1.9.

Alcohol Withdrawn for Denaturation and Denatured Alcohol Produced, Fiscal Years 1907-1929

Fiscal Year	Denaturing Plants	Ethyl Alcohol Withdrawn or Denaturation	Denatured Alcohol Produced — Completely	Denatured Alcohol Produced — Specially	Denatured Alcohol Produced — Total
		Proof Gallons	*Wine Gallons*	*Wine Gallons*	*Wine Gallons*
1907	8	3,084,950.8	1,397,861.16	382,415.19	1,780,276.35
1908	12	5,640,331.2	1,812,122.38	1,509,329.35	3,321,451.73
1909	12	7,967,736.4	2,370,839.70	2,185,579.15	4,556,418.85
1910	12	10,605,870.7	3,076,924.55	3,002,102.55	6,079,027.10
1911	14	11,682,887.9	3,374,019.92	3,507,109.94	6,881,129.86
1912	14	13,955,903.8	4,161,268.56	3,933,246.44	8,094,515.00
1913	21	16,953,552.8	5,223,240.78	4,608,417.76	9,831,658.54
1914	25	17,811,078.2	5,213,129.56	5,191,846.03	10,404,975.59
1915	23	25,411,718.8	5,386,646.96	8,599,821.81	13,986,468.77
1916	33	84,532,253.1	7,871,952.82	38,807,153.56	46,679,106.38
1917	44	93,762,422.7	10,508,919.34	45,170,678.29	55,679,597.63
1918	49	90,644,722.8	10,328,454.61	39,834,561.48	50,163,016.09
1919	45	60,399,308.9	9,976,720.62	28,294,218.97	38,270,939.59
1920	52	45,640,948.6	13,528,402.99	15,307,947.18	28,836,350.17
1921	67	38,812,138.7	12,392,595.02	9,996,229.90	22,388,824.92
1922	77	59,549,919.6	16,193,523.60	17,152,224.31	33,345,747.91
1923	76	105,819,404.9	27,128,229.54	30,436,913.14	57,565,142.68
1924	83	121,576,196.1	34,602,003.72	33,085,292.04	67,687,295.76
1925	91	148,970,220.9	46,983,969.88	34,824,303.28	81,808,273.16
1926	97	191,670,107.2	65,881,442.43	39,494,443.80	105,375,886.23
1927	94	170,633,436.7	56,093,748.16	39,354,928.48	95,448,676.64
1928	82	159,689,378.2	46,966,601.28	45,451,424.28	92,418,025.56
1929	77	182,778,966.1	52,405,451.92	54,555,006.15	106,960,458.07

During the year covered by the Treasury report, a temporary permit was issued to the Carbide & Carbon Chemicals Corporation, of Charleston, W. Va., for the experimental production of synthetic alcohol from ethylene gas. Under this permit aproximately 50,000 proof gallons was produced and later denatured for use in the company's manufacturing process. In commenting on this development, the report states: "The cost figures of production are not known but the mechanical difficulties of producing synthetic ethyl alcohol from ethylene apparently have been solved. If the cost is no greater than the fermentation processes now being used, the quantity is only limited by the quantity of coal and petroleum available. This is probably the most interesting development in the industrial alcohol trade that has occurred for many years."

The large increase in the ethyl alcohol production was attributed to the additional use of completely denatured alcohol for anti-freeze purposes and the tremendous quantity of special denatured alcohol required to prepare lacquer solvents, in the production of rayon and for certain other chemical industries.

Because the alcohol industry has faced the prospect of a higher duty on its chief raw material, blackstrap molasses, it is believed that the industry produced a much greater per cent of the total alcohol quota for the calendar year 1929 during the first six months of the year than would otherwise have been the case. As initiated Jan. 1, 1928, the government enforces a policy of limiting the production of industrial alcohol to the actual needs of legitimate industries. Each industrial alcohol plant is alotted a fixed quota of the total alcohol to be produced, with a provision that only 40 per cent of the total quota for the year could be produced during the first six months of the calendar year, provided that legitimate industries do not require an excess of that quantity. Prohibition Commissioner James M. Doran reports: "This program during the past fiscal year has been of great benefit to the alcohol industry and the trade by preventing an overproduction of alcohol and thus avoiding unstable conditions as regards raw material. This policy has also been a factor in greatly reducing the diversion of industrial alcohol, because there has been a legitimate market for all the alcohol produced during the past fiscal year and no large surplus was accumulated, which is an incentive for fraud if no legitimate market exists."

Alcohol production for 1930 has been tentatively placed at 170,000,000 proof gallons, a reduction of 30,000,000 gallons from last year's output. The reduction was agreed upon by the distillers after considering evidence that there will not be as large a demand for alcohol for industrial purposes this year as in 1929. If a greater demand develops than is anticipated now, the quotas assigned to the several producers by the Bureau of Prohibition under their voluntary working agreement will be revised upward later in the year. The reduction in output was not dictated by evidence that an increasing amount of industrial alcohol is being diverted for beverage purposes, according to Commissioner Doran. Such diversion is a minor factor in the bootleg liquor traffic, he explained. The permissive system is operating effectively, said Dr. Doran, with reference to statements made by Senator Borah and other legislators that it has broken down. The Prohibition Commissioner explained that prompt action is taken whenever there are indications of a leak.

Recent evidence obtained by the Bureau that varnishes, lacquers, thinners, and solvents made under specially denatured alcohol formula No. 44-A were prized for their high alcoholic content has resulted in amending that formula by substituting four gallons of approved wood alcohol for two gallons of gasoline. W. V. Linder, Chief of the Technical Division of the Bureau, explained that there was no abuse of the formula by the permittees manufacturing these products but that in the hands of bootleggers and consumers they were diverted to beverage purposes by extracting the gasoline. It will be impossible to remove the wood alcohol substituted for the gasoline. The amended formula now reads: To every 100 gallons of ethyl alcohol 190 proof, add four gallons of approved wood alcohol (denaturing grade) and 10 gallons of any one of the following denaturants: Normal butyl alcohol, refined fusel oil, amyl alcohol (synthetic or natural).

Commissioner Doran's assertion that the permit system is operating satisfactorily is not expected to sidetrack the attack on prohibition enforcement instigated by Senator Borah, of Idaho, but it also may serve to direct attention to the problem presented by the increasing production of corn sugar, which is described by Dr. Doran as the principal source of illicit alcohol. Citing census figures, Dr. Doran stated that the production of corn sugar had increased from 152,000,000 lb. in 1921 to 968,000,000 lb. in 1928. He said that prohibition agents are reporting seizure of an increasing number of corn sugar stills and a decreasing number of stills used for converting industrial alcohol. A preliminary report of President Hoover's law enforcement commission now is in his hands, but whether this report discusses the permit system will not be known until its presentation to Congress after the appointment of a joint congressional committee to consider separation of the permissive from the law enforcement functions of the bureau and the transfer of the latter from the Treasury Department to the Department of Justice. The House is expected to concur in the Senate's action approving the establishment of this committee.

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New Solvents Eliminate Textile Troubles

Numerous textile problems have been greatly simplified or completely eliminated during the past year by the availability of certain of the new synthetic organic chemicals which formerly were not available on a commercial scale. Diethylene glycol has proven an almost ideal lubricant for wool spinning. Impregnation of the fiber with this chemical makes unnecessary the use of oils and as a consequence eliminates the costly operation of scouring for oil elimination after spinning. The glycol remains in the fibers of the spun yarn or fabric until the first treatment with either wash water or dye solution. At this point the glycol which is water soluble is removed without the necessity of another operation. New possibilities in the printing and dyeing of textiles have been made available by the use of Cellosolve and its derivatives as the medium for making solutions or pastes of dyes and colors. This group of solvents first developed for use in nitrocellulose lacquers has thus found an extensive new application in textiles.

Insecticides

Marketing Problems Important

By L. S. HITCHNER

Secretary-Treasurer, Lucas Kil-Tone Company

DURING the last few years a considerable interest has been aroused over the control of insect pests. This has been largely due to the tremendous devastation of such pests as the Japanese beetle, which made its appearance in New Jersey in 1916. This insect has now spread over parts of Pennsylvania, New York, Delaware, and Maryland. The depredations of the Japanese beetle have been so obvious, completely defoliating orchards, vineyards, trees and flowers, that the public, in the Japanese beetle areas, appreciate as never before the seriousness of the insect infestations. The Southern cotton grower today realizes the fight which he has against the cotton boll weevil, which made its appearance in Texas in 1892. This pest has since spread to all of the Southern states and is strongly entrenched as far north as North Carolina. The bean grower is worrying about the Mexican bean beetle, which first made its appearance in Alabama in 1920 and which has since spread through the eastern part of the United States as far north as New Jersey. The depredations of the Colorado potato beetle are known to every potato grower. Recently the Mediterranean fruit fly made its appearance in Florida—April, 1929. The tremendous economic loss which this fly caused to Florida and the threat which it offers elsewhere are well known.

The seriousness of insect pests is rapidly being realized by the country at large. Fungus diseases as well take yearly an enormous toll in profits from the agriculturists. At the present time, however, very few people, with the possible exception of the commercial orchardist, appreciate this condition, and only a trifling percentage of the growers of the country are using fungicides. Incidentally in most cases the application of the fungicide, either alone or with an insecticide, not only protects the plant from fungus diseases but in many cases the yield is increased so that the cost of the application is not an expense but an investment on which large dividends are paid.

The insecticide and fungicide manufacturers have made considerable progress during the last few years in the commercial production of high quality insecticides and fungicides. The growers throughout the country are rapidly replacing their crude home-made material with commercial products, which are chemically controlled, uniform products. During the past twenty-five years high quality dry powdered arsenate of lead, calcium arsenate, dry lime sulphur, bordos, and sulphur preparations have been developed. More recently oil sprays and other improved insecticides have been placed on the market. These have all proved their merit.

WHILE there is a tremendous amount of research work to be done by the manufacturers, the research and production departments have shown themselves far more capable than the sales and merchandising organizations in the industry. There is always a demand for improved products, but there is now a large capacity for production of excellent materials now manufactured. This excess plant capacity is not due to the lack of a potential market but due mainly to lack of intelligent merchandising and selling plans. Insecticides and fungicides are used but a few months in the year. The demand during that period is variable. The result is that when this demand appears there is either a shortage or an overproduction, both of which are harmful to the industry. This condition is due in a large extent to the lack of proper distribution organizations.

Many manufacturers have made it a practice to sell direct to growers, in many cases at dealers' prices. Prices on the products have been reduced to such figures that there is not a sufficient margin of profit for the distributor to handle the goods at all. The result has been that dealers and distributors will not place orders for these products until the demand is forced upon them. The more intelligent the dealer and the higher rating he enjoys, the more loath he has been to make investments in these products.

Education of the consumer is a necessary function in the sale of insecticides and fungicides. Considering the industry as a whole no educational campaign whatever is or has been conducted. The advertising possibilities from this angle are unlimited. As long as an industry continues a selling policy which does not adequately give to the legitimate distributor and dealer a sufficient margin of profit to warrant an investment in the products of the industry, little progress can be expected. As long as the industry continues in its policy of direct sales without regard to prices, an orderly production and distribution plan cannot be developed.

Growers are today purchasing insecticides and fungicides, in many cases, below manufacturing cost; on the other hand an equal number are paying excessive prices when they need the material. An intelligent merchandising plan by the industry would be a great help to the consumer. The distributor or dealer would carry stock and would be ready to meet the growers' demands when an infestation appeared. The grower would get material when he needed it at a fair price. There would be no danger of a crop loss because of the growers' inability to obtain goods at the opportune time. Over a period of time this would result in lower prices to the consumer, as the manufacturer would have an orderly distribution through legitimate channels of trade. It would permit a longer manufacturing season and a definite plan for production could be scheduled, which is impossible at the present time. The dealer who would be the service station for the manufacturer would make a sufficient profit on his purchases to carry reasonable stocks. An intelligent campaign for the use of the products could be conducted.

The insecticide and fungicide manufacturers have a potential field for the sale of their products with which few other industries can compare. However, until an orderly distribution and merchandising plan is developed the manufacturer, the distributor and the consumer will continue to suffer with an unstabilized price and with a shortage or an overproduction of materials.

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Copper Sulphate Moved in Large Volume

Consuming demand for copper sulphate was active throughout 1928 and this rate of activity was maintained during 1929 with possibly a slight gain in tonnage for the year. The domestic output of copper sulphate has been steadily rising in volume. In 1921, according to census figures, domestic production was 27,221,704 lb. while the 1927 output was reported at 56,666,812 lb. It is estimated about 60,000,000 lb. was produced in 1929.

Imports of copper sulphate last year were in excess of those for the preceding year but export trade was less active and a falling off was registered for the outward movement.

Prices for sulphate were relatively high owing to the strong position of the metal market but in the latter part of the year the price was well stabilized.

Linseed Oil

Erratic Price Movements Recorded

By V. A. ACER

General Sales Manager, Spencer Kellogg & Sons Sales Corporation

THE LINSEED OIL market during 1929 was very erratic and met with several upheavals. After about three consecutive years of large crops in the Argentine and fair crops in the Northwest with linseed oil ruling steadily from 8½c. to 10c. a pound in tankcars, the second half of 1929 saw a tremendous loss of acreage and seed in the Northwest followed by tremendous damage in the Argentine, resulting in prices getting up to 16c. a pound for tankcar oil and working back to 13½c. and 14c. These changes were not steady and gradual but they were erratic fluctuations all the way through. The flaxseed markets went up or down 15c. to 20c. a bushel in a day; linseed oil changed as much as 1c. a pound in one advance or decline.

The United States crop started out with the best acreage in years and was planted and started to grow under favorable conditions, indicating a possible crop as high as 30,000,000 bu. In late June and during July and August it ran into drouth with hot, dry winds, which changed the picture from a potential 30,000,000 bu. to a probable 15,000,000 bu. of seed. About that time they started to plant seed in the Argentine and there they ran into more dry weather until we found the first of November that instead of a total crop of 80,000,000 bu., such as they looked forward to and such as was grown during each of the past three years, the acreage grounded to flaxseed has been abandoned to such an extent and the yields are so poor that the total crop will probably be considerably less than 60,000,000 bu. and it is thought by most experts that the exportable surplus will be under rather than over 50,000,000 bu. There can be no appreciable relief until the approach of the harvest of our next crop in the Northwest, which will be September, 1930. Between now and then we have to go through high prices, possibly some shortage, and doubtless will see some rather violent fluctuations with considerable substitution of inferior products.

China wood oil, as is somewhat natural, gathered considerable strength during the year in sympathy with the big advance in linseed oil, although at its highest it showed nowhere near as much of a peak as did linseed oil. The crop of China wood oil produced in 1930 was said to be rather inferior in quality and smaller in quantity than for the previous years, although accurate information from China is difficult, if not impossible, to obtain. Since October, when conditions looked the worst as far as China wood oil supplies were concerned, the picture has appeared somewhat brighter and prices have receded until now they are about normal and pretty well in line with what they have been for the past two years. The prospects for 1930 at the moment seem very good. China reports a plentiful supply of nuts of good quality. It is felt that the high prices and short supplies of linseed oil will tend to make wood oil relatively more attractive and that we will witness in 1930 a record breaking consumption, providing the supplies from China hold out.

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Tariff Question Affected Vegetable Oils

PROPOSALS to alter existing import duties on vegetable oils attained considerable prominence as a market factor during the year. The probability of higher duties encouraged importers to bring in unusually large amounts of oil before higher imposts should become effective. As the year advanced without any settlement of the tariff question, the large supplies of oil began to press upon the market and very low price levels were reached for many selections.

Domestic production of vegetable oils was on a large scale throughout the year. In the accompanying table, production for the first nine months of 1929 is shown together with the output for the twelve months of 1928. Making allowance for the last quarter of 1929, it is found that decreased output was registered for cottonseed oil but that practically all other oils either equalled or surpassed the totals for the preceding year.

Consumption of vegetable oils also made a favorable comparison with 1928 and the accompanying graph gives *Chem. & Met.'s* estimate for 1929 and actual consumption figures for all of 1927 and 1928.

Imports of Vegetable Oils and Oilseeds

Vegetable Oils

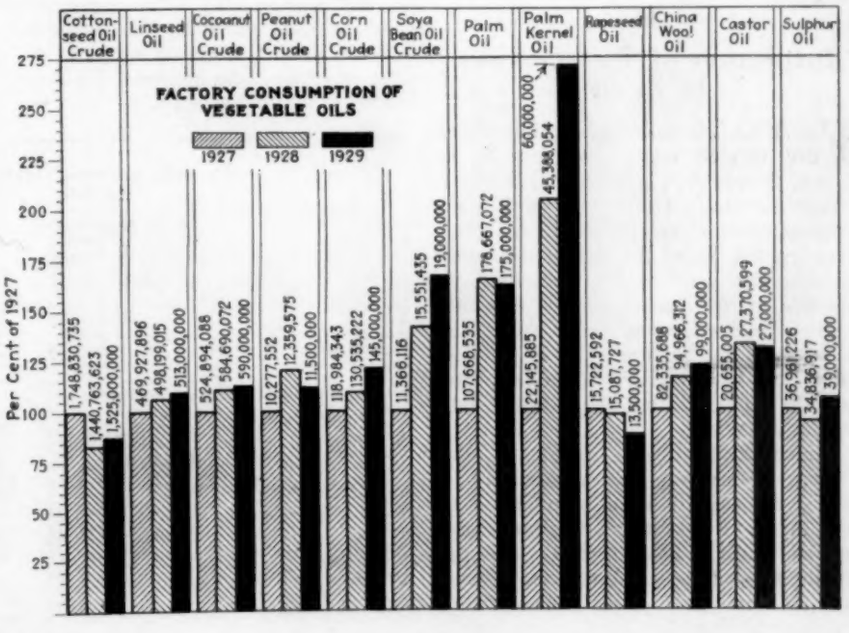
	Jan.-Nov., 1929	Jan.-Nov., 1928
China wood oil, lb.	112,344,383	98,192,181
Cocoanut oil, lb.	372,161,542	254,193,072
Sulphur oil, lb.	43,448,630	35,466,037
Palm oil, lb.	248,319,194	159,080,838
Palm kernel oil, lb.	65,088,383	52,365,285
Sesame oil, lb.	19,914,953	5,587,07?
Peanut oil, lb.	3,009,166	4,399,193
Rapeseed oil, gal.	2,364,973	2,192,950
Linseed oil, lb.	7,630,608	163,893
Soya bean oil, lb.	19,429,129	13,022,333
Perilla oil, lb.	5,574,319	1,928,278

Oilseeds

Cottonseed, lb.	144,072	1,044,366
Castor beans, lb.	167,088,904	125,869,870
Copra, lb.	540,886,281	443,894,704
Flaxseed, bu.	22,953,269	16,045,421
Poppy seed, lb.	6,669,782	5,265,971
Perilla and sesame seed, lb.	17,690,499	8,890,869

Consumption of Refined Cottonseed Oil

	1928 Bbl.	1929 Bbl.
January	270,056	315,839
February	274,137	279,000
March	375,104	272,900
April	274,168	288,900
May	244,340	298,000
June	219,454	304,530
July	266,067	301,150
August	306,000	319,000
September	342,000	357,000
October	348,000	373,000
November	324,000	310,000
December	270,937	.....
Total	3,514,263	3,419,31



Naval Stores

Output Increases

BY ERNEST E. HOLDMAN
Vice-President
General Naval Stores Company
New York

THE NAVAL-STORES industry as a whole looks back upon the year of 1929 as another period of low prices with a production increase of about 10 to 15 per cent. Consumption, on the other hand, shows a decided upward curve. In the steam-and-solvent class of the naval-stores business research and development work have once more proved their full worth. Laboratory and experimental studies continue to be carried on, as has been the practice in this class of the naval-stores industry for the past few years. The comparative statement below of production and stocks of the steam-and-solvent class gives a comprehensive view of the present situation:

Production	1928	1929 Approx.
Wood rosin, bbl. (500 lb.)	420,516	449,532
Steam distilled wood turpentine, bbl. (50 gal.)	75,116	83,460
Steam distilled pine oil, gal.	2,693,949	2,738,367
Stocks	**1928**	**1929 Approx.**
Wood rosin, bbl. (500 lb.)	115,216	88,909
Steam distilled wood turpentine, bbl. (50 gal.)	6,883	8,880
Steam distilled pine oil, gal.	898,610	980,202

Pale grades of wood rosin are on the market today, the types running as high as "WW" and "X." An outstanding feature has been the sale of wood rosin on a net weight basis, which is now available to consumers in this fashion either in metal drums or in wooden barrels.

■

Inspection of Rosin Grows In Favor

FEDERAL inspectors working under the service feature of the U. S. Naval Stores Act, graded 10,727 more round barrels of rosin in the first four months of the present fiscal year than was graded under the act in the same months the year before, according to reports to the Department of Agriculture. In the period July-October in 1928 the total amount of rosin graded was 72,320 round barrels; in the same months of 1929 the total was 83,047 round barrels.

Since the service feature of the Naval Stores Act was inaugurated in 1926, the regular grading of rosin at the stills for producers has gradually grown until now practically all the rosin produced in Louisiana, Texas, and Mississippi is government-graded. Some Alabama rosin is now being graded by request, and this year, for the first time, inspectors were called into Georgia to grade rosin regularly for several producers in that state.

The cost of Government grading is 7 cents per barrel or package, which the Department of Agriculture collects from the person requesting the service. The revenue from the service is barely sufficient to cover the cost of it.

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Will Sell Rosin on Net Weight Basis

FOLLOWING investigations at its naval stores plants during the past year, Hercules Powder Company announces its readiness to supply, for the first time, wood rosin in wooden barrels on a net weight basis. This innovation is expected to effect decided savings for the rosin consuming industry.

The net weight sales plan is instituted by Hercules in response to the desire by consumers for such action. Committees of rosin consumers, representing leading trade associations, have urged the sale of rosin on a net weight basis and the reduction of tares to a minimum. As a result of this development, consumers will eventually realize considerable savings in freight.

■

Casein Production for First Half of 1929

ACCORDING to preliminary figures, domestic production of casein amounted to 11,875,000 lb., the output of 180 factories during the second quarter of 1929. This brings total domestic production of casein for the first six months of 1929 up to approximately 16,570,000 lb.

In 1928 United States production in the second quarter amounted to 7,991,000 lb., the six months total aggregating 12,681,000 lb., hence manufacturing operations in 1929 were on a larger scale than in 1928. The number of factories reporting in 1928 was 140.

Lower Primary Markets for Kauri Gum

AN annual report on the kauri gum industry recently stated that in the early part of this year, a considerable supply of gum stocks accumulated by dealers and others since the boom year of 1920 remained unsold. During the year, gum prices were low, diggers left the fields and production fell off. Old stocks were sold, with the result that a demand was created for government supplies which were sold without disturbing the market or materially affecting current production. Gum washing operations were continued longer than usual this year owing to a wet spring in the north of Auckland, which should cause an increase in gum output. At a meeting of the Kauri Gum Control Board, seven applications were presented by the Lands Department to the Board for upliftment of reservations over portion of kauri gum preserves. Four applications were approved, two held over for inspection and report by the producers' representative for the district and one application refused.

Gum receipts at Auckland for ten months in 1929 totaled 3,378 metric tons, as against 3,351 metric tons in 1928. Nine months figures for exports indicate 3,869 metric tons, valued at $963,000, an increase of 551 metric tons over the year before. From consular invoices, gum exports to the United States compiled during the first ten months of 1929 attained 1,685 metric tons, valued at $552,090, as compared with 1,823 metric tons, having a value of $585,307, for 1928.

Production of Vegetable Oils

	1928 Lb.	1929* Lb.
Cottonseed, crude	1,460,407,149	867,937,975
Cottonseed, refined	1,328,279,276	838,179,914
Peanut, crude	12,439,080	9,103,218
Peanut, refined	9,545,623	7,491,082
Coconut, crude	311,130,463	268,180,244
Coconut, refined	296,650,404	244,250,935
Corn, crude	121,686,657	101,061,499
Corn, refined	104,487,251	93,203,684
Soya bean, crude	4,715,908	5,815,272
Soya bean, refined	7,440,573	6,095,481
Palm kernel, refined	16,086,480	11,309,267
Linseed	751,444,531	572,929,810
Castor	64,521,100	59,038,050

*First 9 months of the year.

Sales of Paint, Varnish and Lacquer Products

	Total Sales	Trade Sales	Industrial Sales	Not Specified
1929				
January	$26,802,547	$9,412,600	$10,179,320	$7,210,627
February	27,136,072	9,711,223	10,229,313	7,195,536
March	34,917,698	12,779,322	12,046,348	10,092,028
April	37,598,532	14,641,742	12,588,654	10,368,136
May	40,565,657	16,780,412	12,963,979	10,821,266
June	36,275,926	14,710,869	11,638,859	10,236,198
July	30,847,807	10,485,349	11,194,819	9,167,639
August	37,163,858	14,441,579	12,788,907	9,933,372
September	31,512,156	11,622,553	10,910,932	8,978,671
October	32,015,837	11,782,217	11,507,014	8,726,606
Total (10 mos.)	$334,796,090	$125,967,866	$116,048,145	$92,780,079
1928				
January	$24,884,023	$8,970,031	$8,733,911	$7,180,081
February	26,389,008	10,138,474	9,088,344	7,162,190
March	32,090,298	12,290,790	10,743,896	9,055,612
April	32,873,608	13,203,359	10,367,386	9,302,863
May	39,111,272	16,685,300	11,426,193	10,999,779
June	36,092,244	14,710,302	11,221,939	10,160,008
July	28,799,974	9,999,887	9,764,839	9,035,248
August	33,315,132	11,885,992	11,876,026	9,553,114
September	30,311,461	10,683,682	10,804,718	8,823,061
October	31,036,574	11,301,852	11,248,229	8,486,493
Total (10 mos.)	$314,903,594	$119,869,669	$105,275,476	$89,758,449

PATENTS ISSUED
Dec. 3 to Dec. 17, 1929

Paper, Pulp and Sugar

Chemical Pulping Process. Bjarne Johnsen, Erie, Pa., assignor to Hammermill Paper Company, Erie, Pa.—1,737,590.

System for Drying Paper and Textiles and the Like. Thomas H. Ireland, Rockville Center, N. Y.—1,737,926.

Paper-Making Method and Machine. William H. Millspaugh, Sandusky, Ohio, assignor to The Paper and Textile Machinery Company, Sandusky, Ohio.—1,739,038.

Process for the Manufacture of a Sugar Product. Walter H. Dickerson, East Orange, N. J., assignor to Industrial Waste Products Corporation, Dover, Del.—1,739,-064.

Manufacture of Sheetlike Articles and the Like from Cellulose. Emil Czapek and Richard Weingand, Bomlitz, near Walsrode, Germany.—1,740,226-7.

Rubber, Rayon, and Plastics

Method of Reclaiming Rubber from Scrap. Lee T. Smith, Kenvil, N. J., assignor to Hercules Powder Company, Wilmington, Del.—1,737,775.

Phenolic Condensation Products and Method of Producing Same. Oscar A. Cherry and Franz Kurath, Chicago, Ill., assignors to Economy Fuse and Manufacturing Company, Chicago, Ill.—1,737,916-7.

Urea and Formaldehyde Condensation Products. Oscar A. Cherry, Chicago, Ill., assignor to Economy Fuse and Manufacturing Company, Chicago, Ill.—1,737,918.

Process for Improving Cotton. Leon Lilienfeld, Vienna, Austria.—1,738,190.

Synthetic Resin and Process for Making Same. Emil E. Novotny, Philadelphia, and Charles J. Romieux, West Philadelphia, Pa., assignors to John Stogdell Stokes, Huntington Valley P. O., Pa.—1,738,310.

Resinous Condensation Product and Process of Preparing Same. Andre Henri Victor Durr, Paris, France, assignor to Compagnie Nationale de Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies, Etablissements Kuhlmann, Paris, France.—1,739,446-8.

Manufacture from Latex of an Artificial Gutta-Percha and a Nonhygroscopic Rubber. Eduard Salomon Ali-Cohen, The Hague, Netherlands.—1,739,566.

Petroleum Refining and Products

Method for Converting Heavier Oil Into Lighter Oils. Robert J. Black, Hammond, Ind., assignor to Sinclair Refining Company, Chicago, Ill.—1,737,634.

Method of Removing Cloud-Forming Materials from Hydrocarbon Oil. Charles L. Suhr and Winfield S. Zehrung, Oil City, Pa., assignors to The Pennzoil Company, Oil City, Pa.—1,737,737.

Fractional-Distillation Apparatus. Richard B. Chillas, Jr., Philadelphia, Pa., assignor to The Atlantic Refining Company, Philadelphia, Pa.—1,738,036.

Process of Treating and Purifying Hydrocarbon Lubricating Oils. William M. Stratford, Port Arthur, Tex., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,738,330.

Vapor Fractionation. Jacque C. Morrell, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,738,386.

Method of Distilling Refined, Cracked Oils Without Avoidable Decomposition or Discoloration. Frank C. Axtell, South Pasadena, Calif., assignor to Axtell Research Laboratories, Inc., Los Angeles, Calif.—1,738,518.

Aparatus for Dephlegmation. Paul J. Duncan, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,-738,766.

Apparatus for the Separation of Hydrocarbons. Edwin R. Cox, Venice, and Howard S. Cole, Jr., Los Angeles, Calif., assignors to California Petroleum Corporation, Los Angeles, Calif.—1,738,870.

Apparatus for Treating Oil. Arthur B. Steen, Houston, Tex., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,740,275.

Coal and Organic Processes

Retort for Carbonizing Bituminous Fuels. Josef Plassmann, Duisburg, Germany, assignor to Chemisch-Technische Gesellschaft m. b. H., Duisburg, Germany.—1,737,681.

Method of Deodorizing Animal and Vegetable Oils. Moses Rogovin, New York, N. Y., assignor, by direct and mesne assigments, to Rogstone Chemical Research Inc., New York, N. Y.—1,737,731,

Reduction of the Swelling Capacity of Hydrated Cellulose and the Resulting Product. Claus Heuck, Ludwigshafen-on-the-Rhine, and Paul Esselmann, Premnitz, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,737,760.

Process of Refining Wood Rosin. Irvin W. Humphrey, Dover, N. J., and Leavitt N. Bent, Holly Oak, Del., assignors to Hercules Powder Company, Wilmington, Del.—1,737,-763.

Apparatus for the Recovery of Gases and Vapors. Oscar L. Barnebey, Columbus, Ohio, assignor to American Solvent Recovery Corporation.—1,737,822.

Manufacture of Phenols. William J. Hale and Edgar C. Britton, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.—1,737,841-2.

Method of Making Alkyl Halides. Ralph H. McKee, Jersey City, N. J., and Stephen P. Burke, New York, N. Y.—1,738,193.

Process of and Apparatus for Carbonizing Material Containing Oil, Fat, Tar, or the Like. Pierre Plantinga, Cleveland, Ohio; The Cleveland Trust Company, executor of said Pierre Plantinga, deceased. —1,738,202.

Process of Manufacturing Carbureted Water Gas. Philip T. Dashiell, Philadelphia, Pa., assignor to The U. G. I. Contracting Company, Philadelphia, Pa. —1,738,493.

Manufacture of Acetaldehyde. Carl N. Hand, Thomas W. Bartram, and Aylmer H. Maude, Nitro, W. Va., assignors to The Rubber Service Laboratories Co., Akron, Ohio.—1,738,649.

Aldehyde Manufacture. Aylmer H. Maude, Nitro, W. Va., assignor to The Rubber Service Laboratories Company, Akron, Ohio.—1,738,659.

Method and Apparatus for Producing Carbon Black. Chauncey Matlock, Brooklyn, N. Y., assignor to Monroe-Louisiana Carbon Company, Monroe, La.—1,738,716.

Process of Making Formaldehyde. Archie J. Weith, Caldwell, and Virgil E. Meharg, Bloomfield, N. J., and Harry W. Ahlbeck, Riverside, Ill., assignors to Bakelite Corporation, New York, N. Y.—1,738,745.

Process of Making Higher Alcohols. Ralph H. McKee and Stephen P. Burke, New York, N. Y., assignors of one-half to Ralph L. Brown, Syracuse, N. Y., and one-half to William W. Odell, Pittsburgh, Pa.—1,738,785.

Manufacture of Methyl Alcohol. Henry Dreyfus, London, England.—1,738,989.

Process of Making Unsaturated Acyl Cellulose Esters. Hans T. Clarke and Carl J. Malm, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,739,210.

Apparatus for Generating Oil Gas. Albert Edward Hodgson and Norman Clarke Jones, London, England.—1,739,461.

Polybasic-Acid-Polyhydric-Alcohol Resin and Method of Making Same. John H. Schmidt, Bloomfield, N. J., assignor to Bakelite Corporation, New York, N. Y.—1,739,771.

Process of Bleaching Fatty Acids. Arne Godal, Vestre Aker, near Oslo, Norway.—1,740,012.

Process of Extracting Turpentine, Pine Oil, and Rosin from Resinous Woods. Robert C. Palmer, Pensacola, Fla., assignor to The Newport Company, Carrollville, Wis. —1,740,115.

Manufacture of High-Melting-Point Wax. Frederick W. Sullivan, Jr., Whiting, Ind., assignor to Standard Oil Company, Whiting, Ind.—1,740,125.

Process for Dehydrating Gas. Walter J. Klaiber, Pittsburgh, Pa., assignor to The Koppers Company.—1,740,248.

Inorganic Processes

Method of Making Arsenates. Clifford D. Carpenter, New York, N. Y.—1,737,639.

Heat-Absorbing Borosilicate Glass and Method of Making the Same. Walter H. Rising, Painted Post, N. Y., assignor to Corning Glass Works, Corning, N. Y.—1,737,685-6.

Method of Making Terra-Cotta Articles. Adolph F. Hottinger, Chicago, Ill., assignor to The Northwestern Terra Cotta Company, Chicago, Ill.—1,737,847.

Cementitious Product and Method of Making the Same. Gustav A. Witte, Riverside, Calif., assignor to International Precipitation Company, Los Angeles, Calif.—1,737,904.

Manufacture of Ammonia. Charles Urfer, Geneva, Switzerland, assignor to Société d'Etudes Minières & Industrielles, Paris, France.—1,737,953.

Conversion of Lead Sulfate and Lead Chloride into Lead Carbonate. Stanley Cochran Smith, London, England, assignor of one-half to Chemical & Metallurgical Corporation Limited, London Wall, England.—1,738,081.

Cyanogen-Chloride Hydrocyanic-Acid Mixture. Guy H. Buchanan, Westfield, N. J., assignor to American Cyanamid Company, New York, N. Y.—1,738,280.

Calcium-Magnesium-Chloride Product and Method of Making Same. William R. Collings and John J. Shafer, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.—1,738,492.

Process for the Manufacture of Titanium Dioxide. Fritz Doerinckel, Feverhusen and Ludwig Mehler, Dormagen, Germany, assignors, by mesne assignments, to Titanium Pigment Co., Inc., New York, N. Y.—1,738,765.

Process for Refining Crude Borax. Charles F. Ritchie and William A. Gale, Trona, Calif., assignors, by mesne assignments, to American Potash & Chemical Corporation, New York, N. Y.—1,739,091.

Process of Making Chromic Acid. Marvin J. Udy, Niagara Falls, N. Y.—1,739,107.

Synthetic Ammonia Process. Joseph G. Dely, Syracuse, N. Y., assignor to Atmospheric Nitrogen Corporation, Solvay, N. Y. —1,739,217.

Process of Producing Soluble Lead Reagents. Deric William Parkes, Ryders Green, West Bromwich, England, assignor of one-half to Herbert William Robinson, Birmingham, England.—1,740,312.

Chemical Engineering Processes and Equipment

Electric Furnace. Paul Brown, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,737,566.

Mixing Machine. Claudius Nielsen, Detroit, Mich.—1,737,609.

Catalytic Gas Generator. Fred Umpleby, Lockwood, Huddersfield, England.—1,738,-620.

Process for the Production of Dense Foam. George Miller Thomson, Caledonia, Ontario, Canada, assignor, by mesne assignments, to Canada Gypsum and Alabastine Company, Limited, Paris, Ontario, Canada.—1,737,623.

Agitator. Joseph E. Bond, Appleton, Wis.—1,737,699-705.

Conveyor. Arthur J. Howe, Cuyahoga Falls, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y.—1,737,762.

Apparatus for Pulverizing Material. William J. A. London, Hartford, Conn., assignor to Peabody Engineering Corporation, New York, N. Y.—1,737,800.

Flow-Detecting System. Carl H. Ehlers, Penfield, Pa., assignor to The Atlantic Refining Company, Philadelphia, Pa.—1,737,-835.

Heat-Transfer Apparatus. Jens N. Jacobsen, Alameda, Calif., assignor to The Pfaudler Company, Rochester, N. Y.—1,737,849.

Centrifugal Pulverizer. Otto A. Kreutzberg, Lake Bluff, Ill.—1,737,854.

Apparatus for Continuously Expelling the Sulphur Dioxide from Mixtures of Sulphur Dioxide and Oil. Paul Jodeck, Berlin, Germany, assignor to Allgemeine Gesellschaft für Chemische Industrie m. b. H., Berlin-Schoneberg, Germany.—1,738,070.

Centrifugal Separator. Hallvard Ness, Oslo, Norway.—1,738,258.

Homogenizing Mill. William Eppenbach, College Point, N. Y., assignor to United States Colloid Mill Corporation, Long Island City, N. Y.—1,738,288.

Electrolytic Cell. Robert Edgeworth-Johnstone, London, England.—1,738,372.

Impregnation of Porous Gels with Metals or Other Insoluble Material. Harry N. Homles, Oberlin, Ohio—1,739,306.

Production of Absorbent Material. Thomas Perey Hilditch, Grappenhall, and Harold Joseph Wheaton, Warrington, England, assignors, by mesne assignments, to Harry N. Holmes, Oberlin, Ohio.—1,739,305.

Apparatus for the Production of Carbon Monoxide, Formic Acid and Formaldehyde. William C. Arsem, Schenectady, N. Y., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,740,139-41.

Electrodes and Process for Making the Same. Colin G. Fink, Yonkers, and Russell E. Lowe, New York, N. Y., assignors to Bario Metal Corporation, New York, N. Y. —1,740,291.

Prices

Revised Index Offers More Accurate Barometer

ECONOMIC PHASES of the chemical industry are so directly affected by price trends that the importance of the latter to producers and consumers is obvious. In order that a reliable comparative basis might be available for the industry, *Chem. & Met.*, for several years has issued a weighted index number for prices of chemicals and of oils and fats.

The weighted numbers were established on a basis of total available supplies—production plus imports—of the commodities included in the index. Through the inclusion of a base price, these quantities were interpreted in terms of value and the relative importance of each selection was then determined.

In January, 1925, the weighted index number was revised to meet more closely the change in conditions which had developed within the respective industries. Production was based on the census figures for 1923 and the base price represented the average for 1913-1914. So many changes in the production status of various chemicals and oils have arisen since 1923 that a further revision of the index was believed to be necessary for an accurate presentation of price comparisons. Hence, beginning with this issue, the weighted price numbers will be based on production returns and imports for 1927 and the base price also will be figured on the levels current in 1927.

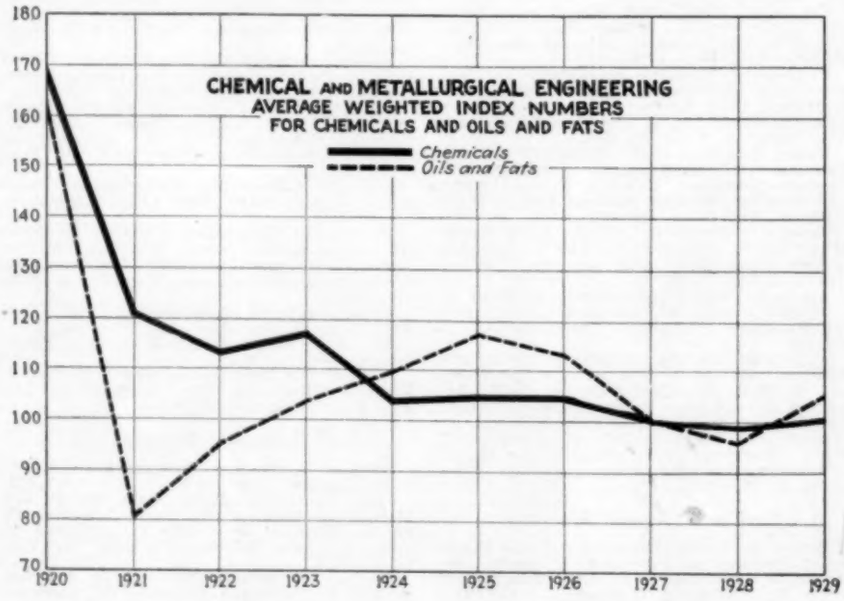
THE index for chemicals has been expanded to take in thirty selections. The additions include arsenic, calcium carbide, carbon bisulphide, ethyl acetate, turpentine and tri-sodium phosphate. Caustic potash has been dropped and liquid chlorine has been substituted for bleaching powder. Arsenic has been selected because of its importance as a basic material for insecticide manufacture. Calcium carbide, carbon bisulphide and tri-sodium phosphate have gained so rapidly from a tonnage standpoint that their price influence has become too important to disregard. Ethyl acetate, likewise, has taken its place among the important chemicals and seems destined for continued expansion. The growing importance of the solvents group is sufficient explanation for the inclusion of turpentine among the commodities rounding out the index.

Revision of the weighted index brings about changes which invalidate comparisons with the numbers calculated on the former basis. In the first place the extension of the index so as to include 30 chemicals instead of 25 admits of influences which formerly did not enter into the price computations. Especial mention may be made of turpentine. This solvent is subject at times to drastic fluctuations and because of its quantity rating it frequently is an important factor in directing the trend of the index number. Calcium carbide and sodium silicate rate high from a tonnage standpoint but are more stable in price. Liquid chlorine, with its steady growth of output, takes a higher place in the valuation column than did bleaching powder, which it has replaced.

Moreover, while the chemical industry has shown a steady growth in recent years, the rate of increase has not been uniform as far as the individual selections are concerned. Some of the basic chemicals, such as alkalis and sulphuric acid, have forged ahead more rapidly than the majority of chemicals. This has resulted in higher index factors for

Basic Data for Chem. & Met. Weighted Index of Chemical Prices

Commodity	Basic Price, 1927	Total Production, 1927	Imports, 1927	Total Supply
Acid, acetic, 28%.....	$3.38 per 100 lb.	151,375,300 lb.	18,930,992 lb.	170,306,292 lb.
Acid hydrochloric, 20°..	.90 per 100 lb.	443,778,000 lb.	100,000 lb.	443,878,000 lb.
Acid nitric, 42°.....	6.50 per 100 lb.	274,578,000 lb.	36,508 lb.	274,614,508 lb.
Acid sulphuric, 60°.....	10.50 per 100 lb.	5,953,012 ton	17,434 ton	5,970,446 ton
Alcohol, den. No. 5.....	.395 per gal.	40,383,574 gal.	6,250 gal.	40,389,824 gal.
Methanol, 95%.....	.635 per gal.	5,732,699 gal.	1,714,692 gal.	7,447,391 gal.
Aluminum sulphate.....	1.40 per 100 lb.	608,862,000 lb.	1,532,766 lb.	610,394,766 lb.
Ammonia, anhyd.....	.1118 per lb.	45,233,000 lb.	Nil	45,233,000 lb.
Ammonium sulphate....	2.4375 per 100 lb.	1,228,219,041 lb.	34,306,000 lb.	1,262,525,041 lb.
Aniline oil.....	.14875 per lb.	27,084,227 lb.	13,740 lb.	27,097,967 lb.
Arsenic, white.....	.38125 per lb.	23,460,000 lb.	25,033,649 lb.	48,493,649 lb.
Benzol.....	.23 per gal.	21,939,000 gal.	2,991,729 gal.	24,930,729 gal.
Borax.....	.03625 per lb.	129,728,000 lb.	140,000 lb.	129,868,000 lb.
Calcium carbide.....	.05 per lb.	403,910,000 lb.	4,550,726 lb.	408,460,726 lb.
Carbon bisulphide.....	.055 per lb.	44,972,489 lb.	Nil	44,972,489 lb.
Chlorine, liquid.....	.04 per lb.	286,410,000 lb.	Nil	286,410,000 lb.
Ethyl acetate.....	.8066 per gal.	4,645,342 gal.	3,748 gal.	4,649,090 gal.
Formaldehyde.....	.1056 per lb.	30,846,948 lb.	2,235,960 lb.	33,082,908 lb.
Lithopone.....	.055 per lb.	315,753,077 lb.	15,957,900 lb.	331,710,977 lb.
Phenol U.S.P.....	.1675 per lb.	8,041,082 lb.	500 lb.	8,041,582 lb.
Salt cake.....	17.00 per ton	202,636 ton	11,172 ton	213,808 ton
Soda ash, 58% light....	1.325 per 100 lb.	4,076,614,000 lb.	99,372 lb.	4,076,713,372 lb.
Soda, caustic solid, 76%	3.00 per 100 lb.	1,167,946,000 lb.	173,302 lb.	1,168,119,302 lb.
Sodium bichromate.....	.0625 per lb.	64,824,000 lb.	55,791 lb.	64,879,791 lb.
Sodium phosphate-tri...	.039 per lb.	108,894,000 lb.	2,255,000 lb.	111,149,000 lb.
Sodium silicate 40.....	.75 per 100 lb.	999,714,000 lb.	154,059 lb.	999,868,059 lb.
Sulphur.....	18.00 per ton	2,111,618 ton	3,384 ton	2,115,002 ton
Turpentine, spirits.....	.6254 per gal.	31,549,082 gal.	315,453 gal.	31,864,535 gal.
White lead, dry.....	.09166 per lb.	331,617,056 lb.	330,421 lb.	331,947,477 lb.
Zinc oxide.....	.065 per lb.	342,863,976 lb.	2,797,024 lb.	345,661,000 lb.



Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1927

This month	**98.57**
Last month	99.73
January, 1929	100.02
January, 1928	100.66

Lower prices went into effect for dry white lead, formaldehyde, methanol, and tri-sodium phosphate. Easier tones also were noted in sales of liquid chlorine and lithopone. Anhydrous ammonia sold on contracts at higher levels than a year ago.

those chemicals. To a greater or less extent the relative weights of the other chemicals making up the index have been altered by productive developments in recent years. Price trends in chemical groups likewise have been variable, which is directly reflected in their relative influences on the index structure. With these factors destroying the comparability of the old and new index numbers, the accompanying table, compiled on the revised basis, has been prepared so that comparisons of index numbers may be available for the ten-year period just ended.

REFERENCE to the accompanying table calls attention to the high level of prices which prevailed in 1920. The impetus given to values during the preceding war-years and the after-war expansion period was still in evidence. The downward trend for values, however, became apparent before the end of that year and gradually prices sank until they more closely approached those current in pre-war years. Labor and other costs of production remained too high to admit of a return to pre-war prices but improvements in processes and in production methods in general made it possible to maintain a fairly low price level from 1922 up to the present. The stabilization of prices became more pronounced in recent years and has been aided by the trend toward more direct relations between producer and consumer. The increase in contract sales also has contributed to the steadiness of values since it has offered a more definite basis for planning future production and at the same time has enabled producers to cover their requirements for raw materials ahead and thus hold producing costs on a steady level.

The progress which has been made in the last few years along the lines of synthetic production of chemicals has not been without price significance. Current prices for methanol and ammonia will illustrate the influence which synthetic production has exerted on the market.

The weighted index number for chemicals in January, 1929, stood at 100.02 and in December it had declined to 99.73. Perhaps the most decided price trend of the year was found in the case of nitrogen bearing materials. Air-fixation of nitrogen has been gaining in practically all countries and values for nitrate of soda and sulphate of ammonia have reflected this condition which promises to continue for some time to come.

In the revision, no change has been made in the commodities which comprise the index for oils and fats. Cottonseed oil continues to hold its place as the most important factor in this index. The position of other oils and fats has not been materially changed. China wood oil, though not as yet a domestic product, is steadily broadening its consuming outlets. Sulphur oil, or olive oil foots, bulks larger in recent import statistics and consequently is more important as an index factor. Soya bean and peanut oils have not regained the position they held prior to 1922 and exert only minor influence on price averages.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1927

This month	**93.89**
Last month	97.52
January, 1929	98.72
January, 1928	100.77

Price changes during the month were in favor of buyers. Crude cottonseed, linseed, corn and peanut oils were quoted at reduced figures. Tallow also sold off although rumors of an anticipated advance were current at the close. Glycerine was easy for the greater part of the period.

Basic Data for Chem. & Met. Weighted Index of Prices for Oils and Fats

Commodity	Base Price, 1927	Production, 1927	Imports, 1927	Total Supply
Cottonseed oil, crude	$0.08146 per lb.	1,806,756,866 lb.	Nil	1,806,756,866 lb.
Linseed oil	.1048 per lb.	776,714,498 lb.	946,432 lb.	777,660,930 lb.
Coconut oil	.0824 per lb.	281,654,384 lb.	293,369,704 lb.	575,024,088 lb.
Corn oil crude	.0832 per lb.	117,440,681 lb.	Nil	117,440,681 lb.
China wood oil	.1922 per lb.	Nil	89,650,411 lb.	89,650,411 lb.
Castor oil, No. 3	.131 per lb.	49,400,874 lb.	18,962 lb.	49,419,836 lb.
Soya bean oil	.1203 per lb.	3,087,670 lb.	14,914,792 lb.	18,002,462 lb.
Peanut oil, crude	.112 per lb.	10,589,613 lb.	2,847,424 lb.	13,437,037 lb.
Palm oil, Lagos	.0794 per lb.	Nil	159,911,079 lb.	159,911,079 lb.
Menhaden oil	.4472 per gal.	4,083,694 gal.	Nil	4,083,694 gal.
Tallow, inedible	.08448 per lb.	404,163,524 lb.	12,907,738 lb.	417,071,262 lb.
Red oil	.0956 per lb.	55,684,015 lb.	78,566 lb.	55,762,581 lb.
Oleo oil No. 1	.1382 per lb.	127,593,896 lb.	816,759 lb.	128,410,655 lb.
Sulphur oil	.095 per lb.	Nil	42,307,314 lb.	42,307,314 lb.
Glycerine, crude	.14 per lb.	128,208,642 lb.	14,943,670 lb.	143,152,312 lb.

THE output of the majority of vegetable oils is dependent upon the supply of oilseeds and other oil-bearing materials which in turn is dependent upon the variable conditions which are encountered in the respective crop-raising periods. Hence, sales prices for oils are less stable than those for chemicals and greater fluctuations are found in the weighted index numbers. As some oils, either are not produced in this country or the home output is not large enough to take care of consuming requirements, it is necessary to call upon foreign sources of supply. This brings into price account, the position of primary markets abroad. China wood oil may be cited as a case in point with landed values varying according to changes in the Hankow market as nearly 85 per cent of imports in 1929 claimed Hankow as the shipping port.

***Chem. & Met.* Weighted Index Numbers for Chemicals**

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
January	149.56	133.55	111.70	117.91	107.09	105.86	106.17	103.20	100.66	100.02
February	157.76	130.05	110.07	118.80	106.79	106.08	103.96	102.40	100.45	100.01
March	168.67	125.34	110.43	119.97	106.17	106.55	104.88	101.92	99.62	100.50
April	183.14	122.88	113.14	118.60	106.34	104.79	105.32	101.53	100.04	100.31
May	186.63	120.34	111.05	117.13	104.21	103.91	103.54	101.05	99.85	100.31
June	177.39	123.16	109.82	115.46	103.61	103.37	102.86	100.95	98.67	100.25
July	180.01	119.05	111.36	114.71	101.88	102.79	104.28	99.72	98.49	100.03
August	187.85	115.75	111.49	115.65	101.72	104.16	104.96	99.84	98.84	99.75
September	174.42	117.01	114.56	115.93	101.94	104.45	104.78	100.01	99.16	100.19
October	169.54	115.39	117.09	116.52	102.23	102.83	104.81	99.72	99.30	100.13
November	155.35	116.82	117.87	116.27	102.35	103.97	104.55	99.30	99.47	99.95
December	136.83	114.24	118.27	115.92	102.19	104.14	102.95	99.51	99.58	99.73

***Chem. & Met.* Weighted Index Numbers for Oils and Fats**

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
January	206.72	86.94	84.63	97.50	110.80	126.60	115.98	93.13	100.77	98.72
February	208.74	80.84	91.22	101.97	106.04	115.62	111.08	98.89	94.54	101.15
March	197.54	71.76	102.58	109.79	101.61	120.98	115.75	100.70	94.63	101.11
April	199.14	61.78	100.91	113.67	102.50	115.91	113.05	97.66	98.22	97.65
May	180.22	72.46	101.86	111.06	98.89	115.39	119.91	99.23	99.62	92.52
June	176.71	76.64	100.03	106.12	99.43	114.67	132.94	100.71	95.83	91.57
July	173.80	83.21	96.99	98.98	112.28	114.36	126.87	100.67	95.11	91.84
August	142.35	85.41	94.13	98.83	124.84	118.59	119.27	101.50	94.07	95.74
September	130.71	92.52	87.22	99.83	107.49	115.91	115.49	108.35	94.49	99.81
October	131.98	85.93	90.92	100.47	114.13	115.73	97.52	105.51	96.97	104.50
November	110.16	82.92	95.43	100.85	113.92	116.19	96.18	104.01	95.30	98.51
December	91.76	83.65	95.90	102.09	119.75	115.53	91.69	100.25	97.67	97.52

Comparative Prices in New York Market, 1929

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. producing points, the quotations are given on that basis and are so designated. The figures show the opening price, the high, the low and the closing price for 1929.

Industrial Chemicals

			Jan. 2	High	Low	Dec. 31
Acetone, drums		lb.	$0.14	$0.14	$0.11	$0.11
Acid, acetic, 28% bbl	100	lb.	3.88	3.88	3.88	3.88
Boric, bbl		lb.	.06½	.06½	.05½	.06½
Citric, kegs		lb.	.46	.46	.46	.46
Lactic, 44%, tech. light, bbl		lb.	.12	.12	.11½	.11½
22% tech. light, bbl		lb.	.05½	.05½	.05½	.05½
Muriatic, 18°, tanks	100	lb.	.90	1.00	.90	1.00
Nitric, 36° carboys	100	lb.	5.00	5.00	5.00	5.00
Oxalic, bbl		lb.	.11	.11½	.11	.11½
Sulphuric, 60° tanks		ton	11.00	11.00	11.00	11.00
Tartaric, powd., bbl		lb.	.37½	.38	.37½	.37½
Alcohol, butyl, tanks		lb.	.18½	.18½	.16½	.16½
Ethyl, 190 p'f U.S.P., bbl		gal.	2.68	2.68	2.68	2.68
Alcohol, denatured, 190 proof						
No. 1 special, dr		gal.	.48	.51	.48	.51
No. 5, 188 proof, dr		gal.	.48	.50	.48	.50
Alum, ammonia, lump, bbl		lb.	.03½	.03½	.03½	.03½
Potash, lump, bbl		lb.	.02½	.03	.02½	.03
Aluminum sulphate, com. bags	100	lb.	1.40	1.40	1.40	1.40
Ammonia, agua, 26°, tanks		lb.	.03½	.03½	.03	.03
Anhydrous, cyl		lb.	.13½	.14	.13½	.14
Ammonium carbonate, powd., tech., casks		lb.	.12	.12	.12	.12
Ammonium sulphate, wks	100	lb.	2.30	2.35	2.05	2.05
Amyl acetate tech., dr		lb.	.244	.244	.15	.15
Arsenic, white, bbl		lb.	.04	.04	.04	.04
Barium carbonate, bbl		ton	47.50	58.00	47.50	58.00
Chloride, bbl		ton	63.00	64.00	63.00	64.00
Nitrate, casks		lb.	.07½	.07½	.07	.07
Bleaching powder, wks., dr	100	lb.	2.00	2.00	2.00	2.00
Borax, bbl		lb.	.02½	.033	.02½	.033
Calcium acetate, bags	100	lb.	4.50	4.50	4.50	4.50
Arsenate, dr		lb.	.06½	.08	.06½	.08
Carbide, dr		lb.	.05	.05	.05	.05
Chloride, dr., wks		ton	20.00	20.00	20.00	20.00
Carbon bisulphide, dr		lb.	.05	.05	.05	.05
Carbon tetrachloride, dr		lb.	.06½	.06½	.06½	.06½
Chloride, liquid, tanks, wks	100	lb.	2.00	3.00	2.75	2.75
Cobalt oxide, bbl		lb.	2.10	2.10	2.10	2.10
Copperas, bulk, wks		ton	16.00	16.00	15.00	15.00
Copper carbonate, bbl		lb.	.16½	.22	.13	.13
Sulphate, bbl	100	lb.	5.50	7.00	5.50	5.50
Cream of tartar, bbl		lb.	.27½	.27½	.26½	.26½
Epsom salt, dom., tech., bbl	100	lb.	1.75	2.25	1.75	2.25
Imported, tech., bags	100	lb.	1.15	1.15	1.15	1.15
Ethyl acetate, dr		lb.	.119	.14	.1012	.1012
Formaldehyde, 40%, bbl		lb.	.09½	.09½	.08½	.08½
Fusel oil, crude, dr		gal.	1.30	1.30	1.30	1.30
Glaubers salt, bags	100	lb.	1.10	1.10	1.10	1.10
Glycerine, C.P., dr		lb.	.14	.15½	.14	.14
Crude, soaplye		lb.	.08½	.08½	.07	.07
Lead:						
White, basic carbonate, dry		lb.	.08½	.09	.08½	.09
White, basic sulphate, casks		lb.	.07½	.08½	.07½	.08½
Red, dry		lb.	.10	.11½	.09½	.09½
Acetate, white, crys., bbl		lb.	.13	.14½	.13	.14½
Arsenate, powd., bbl		lb.	.13	.14	.13	.14
Lithopone, bags		lb.	.05½	.05½	.05	.05
Magnesium carbonate, tech., bags		lb.	.06½	.06½	.06½	.06½
Methanol, 95%, dr		gal.	.58	.58	.50	.52
97%, dr		gal.	.60	.60	.52	.54
Nickel salts, double, bbl		lb.	.12½	.12½	.12½	.12½
Single, bbl		lb.	.12½	.12½	.12½	.12½
Phosphorus, yellow, cases		lb.	.32	.32	.31	.31
Potassium bichromate, casks		lb.	.08½	.09	.08½	.09
Carbonate, 80-85%, calc'd, casks		lb.	.05½	.05½	.05½	.05½
Chlorate		lb.	.07½	.08	.07½	.08
Hydroxide (caust. potash) drums		lb.	.07½	.07½	.06½	.06½
Muriate, 80%, bags		ton	36.75	36.75	36.75	36.75
Nitrate, bbl		lb.	.06	.06	.06	.06
Permanganate, dr		lb.	.15	.16	.15	.16
Prussiate, yellow, casks		lb.	.19	.19	.18½	.18½
Sal ammoniac, white, casks		lb.	.046	.046	.046	.046
Sal soda, bbl	100	lb.	.90	.90	.90	.90
Soda ash, light, bags	100	lb.	1.32	1.32	1.32	1.32
Soda, caustic, 76%, solid, drums	100	lb.	2.80	2.90	2.80	2.90
Sodium acetate, bbl		lb.	.05	.06½	.05	.05½
Sodium bicarbonate, bbl	100	lb.	2.00	2.00	2.00	2.00
Sodium bichromate, casks		lb.	.07	.07	.07	.07
Sodium chlorate, kegs		lb.	.06½	.07½	.06½	.07½
Sodium cyanide, cases		lb.	.18	.18	.18	.18
Sodium fluoride, bbl		lb.	.08½	.08½	.08½	.08½
Sodium nitrate, bags	100	lb.	2.15	2.20	2.00	2.10
Sodium nitrite, casks		lb.	.07½	.07½	.07½	.07½
Sodium phosphate, dibasic		lb.	.03½	.03½	.03½	.03½
Sodium phosphate, tribasic	100	lb.	3.90	3.90	3.60	3.60
Sodium prussiate, yellow		lb.	.11½	.12	.11½	.11½
Sodium silicate, 40°, dr	100	lb.	.75	.75	.70	.70
Sodium sulphide, fused, 60-62%, drums	100	lb.	.02½	.03	.02½	.02½

Industrial Chemicals—*Continued*

			Jan. 2	High	Low	Dec. 31
Sodium sulphite, crys., bbl		lb.	$0.02½	$0.03	$0.02½	$0.03
Strontium nitrate, bbl		lb.	.09	.09	.08½	.09
Sulphur, crude, mine, bulk		ton	18.00	18.00	18.00	18.00
Tin bichloride, bbl		lb.	.15½	.15½	.13½	.13½
Tin oxide, bbl		lb.	.54	.54	.42	.42
Tin crystals, bbl		lb.	.37½	.37½	.32½	.32½
Zinc chloride, bbl		lb.	.06½	.06½	.06	.06
Zinc oxide, lead free		lb.	.06½	.06½	.06½	.06½
5% lead sulphate		lb.	.06½	.06½	.06½	.06½
Zinc sulphate	100	lb.	2.75	3.25	2.75	3.25

Coal-Tar Products

Alpha-naphthol, cr., bbl		lb.	$0.60	$0.60	$0.60	$0.60
Alpha-naphthol, ref., bbl		lb.	.80	.80	.80	.80
Alpha naphthylamine, bbl		lb.	.32	.32	.32	.32
Aniline oil, drums		lb.	.14½	.15	.14½	.15
Aniline salts, bbl		lb.	.24	.24	.24	.24
Benzaldehyde, U.S.P., dr		lb.	1.15	1.15	1.15	1.15
Benzene, 90%, tanks, works		gal.	.23	.23	.23	.23
Benzidine base, bbl		lb.	.67	.67	.65	.65
Benzoic acid, U.S.P., kegs		lb.	.60	.60	.51	.51
Benzyl chloride, tech., dr		lb.	.25	.25	.25	.25
Beta-naphthol, tech., bbl		lb.	.22	.22	.22	.22
Beta naphthylamine, tech		lb.	.65	.65	.60	.60
Cresol, U.S.P., drums		lb.	.14	.14	.14	.14
Cresylic acid, 90%, dr., works		gal.	.65	.65	.60	.60
95-97% drums, works		gal.	.58	.67	.58	.67
Diethylaniline, drums		lb.	.55	.55	.55	.55
Dimethylaniline, drums		lb.	.27	.27	.26	.26
Dinitrophenol, bbl		lb.	.30	.30	.30	.30
Dinitrotoluene, bbl		lb.	.17	.17	.17	.17
Diphenylamine, bbl		lb.	.42	.42	.40	.40
H-acid, bbl		lb.	.60	.68	.60	.68
Monochlorbenzene, drums		lb.	.10	.10	.09½	.09½
Monoethylaniline, drums		lb.	1.05	1.05	1.05	1.05
Naphthalene, flake, bbl		lb.	.04½	.04½	.04½	.04½
Naphthalene, balls, bbl		lb.	.05½	.05½	.05½	.05½
Naphthionate of soda, bbl		lb.	.54	.54	.50	.50
Nitrobenzene, drums		lb.	.09	.09	.08½	.08½
N-W acid, bbl		lb.	.85	.85	.85	.85
Ortho-aminophenol, kegs		lb.	2.15	2.15	2.15	2.15
Ortho-dichlorbenzene, bbl		lb.	.08	.08½	.08	.08½
Ortho-nitrophenol, bbl		lb.	.85	.85	.85	.85
Ortho-toluidine, bbl		lb.	.25	.27	.25	.27
Para-aminophenol, base, kegs		lb.	1.05	1.05	.97	.97
Para-dichlorbenzene, bbl		lb.	.17	.17	.17	.17
Para-nitroaniline, bbl		lb.	.55	.55	.51	.51
Para-nitrotoluene, bbl		lb.	.28	.28	.28	.28
Para-phenylenediamine, bbl		lb.	1.15	1.20	1.15	1.20
Para-toluidine, bbl		lb.	.38	.38	.38	.38
Phthalic anhydride, bbl		lb.	.20	.20	.16	.16
Phenol, U.S.P., drums		lb.	.13	.14½	.13	.14½
Picric acid, bbl		lb.	.30	.30	.30	.30
Resorcinol, tech., kegs		lb.	1.30	1.30	1.15	1.15
R-salt, bbl		lb.	.44	.44	.44	.44
Salicylic acid, tech., bbl		lb.	.37	.37	.33	.33
Salicylic acid, U.S.P., bbl		lb.	.40	.40	.38	.38
Solvent naphtha, crude, tanks		gal.	.30	.30	.30	.30
Sulphanilic acid, crude, bbl		lb.	.15	.15	.15	.15
Toluidine, mixed, kegs		lb.	.95	.95	.91	.91
Toluene, tanks, works		gal.	.35	.40	.35	.40
Xylene, 5%, drums		gal.	.45	.45	.40	.40
Xylene, com., tanks		gal.	.36	.36	.30	.30

Oils and Fats

Castor oil, No. 3, bbl		lb.	$0.13½	$0.13½	$0.12½	$0.12½
China wood oil, drum		lb.	.14½	.15½	.13½	.13½
Coconut oil, Ceylon, tanks, N. Y		lb.	.08½	.08½	.06½	.07½
Corn oil, crude, tanks, f.o.b. mill		lb.	.08½	.09½	.07½	.07½
Cottonseed oil, crude, f.o.b. mill		lb.	.08½	.09½	.07	.07
Linseed oil, raw, car lots, bbl		lb.	.10	.163	.098	.145
Palm oil, Lagos, casks		lb.	.09½	.09½	.07	.07½
Niger, casks		lb.	.09	.09½	.06½	.07
Peanut oil, crude, tanks, mill		lb.	.10	.10½	.07½	.07
Rapeseed oil, ref., bbl		gal.	.84	.86	.71	.71
Soya bean, tanks, f.o.b. Coast		lb.	.10	.10½	.09½	.09½
Sulphur (olive foots) bbl		lb.	.10½	.11½	.08	.08½
Cod, Newfoundland, bbl		gal.	.65	.65	.57	.57
Menhaden light pressed, bbl		gal.	.60	.70	.60	.64
Crude, tanks, f.o.b. factory		gal.	.48	.48	.43	.45
Grease, yellow, loose		lb.	.07½	.08½	.06½	.06½
Oleostearine		lb.	.10½	.12	.09½	.09½
Red oil, distilled, d.p., bbl		lb.	.09½	.10½	.09½	.10½
Tallow, extra, loose		lb.	.09½	.09½	.07½	.07½

Miscellaneous

Carbon gas, black		lb.	$0.08	$0.08	$0.06	$0.06
Casein dom., tech., bbl		lb.	.15	.16½	.14½	.14½
Rosin, H		bbl.	9.45	9.75	8.35	8.70
Turpentine, spirits		gal.	.63	.63	.51½	.56½
Shellac, T.N., bags		lb.	.45	.45	.33	.33
Copper, electrolytic		lb.	.16½	.24	.16½	.18
Lead, New York	100	lb.	6.50	7.75	6.25	6.25
Quicksilver		flask	122.00	125.00	119.50	121.00
Tin, Straits		lb.	.49½	.50½	.30½	.39
Zinc	100	lb.	6.70	7.15	5.80	5.80

MARKET APPRAISAL OF CHEMICAL INDUSTRY

Price Jan. 2, 1929	Net Change 1929	Price Range in 1929 High	Price Range in 1929 Low	Sales in 1929	Stock	Price Dec. 2	Price Range in December High	Price Range in December Low	Dec. 31
99¼	24¼	223¼	77	1,639,300	Air Reduction	130½	143	106½	124¼
10½	— 9¼	11½	1	673,100	Ajax Rubber	2½	2½	1	1¼
255	10	354½	197	1,032,350	Allied Chemical	247	285	240	265
121¼	1	125	118½	35,600	Allied Chemical, pf	124	124½	121	121
20¼	—13¼	23¼	4	263,600	Am. Ag. Chemical	6¼	8¼	6¼	7
71½	—45	73½	18	182,400	Am. Ag. Chemical, pfd	26½	34	24½	26½
58½	..	69½	20½	1,931,300	American Cyanamid, B	27½	29½	20½	28
10	— 6	10	3½	27,200	Am. Hide & Leather	5	5½	3½	4
62	—15½	81¼	31½	1,658,000	American Metals	43½	52½	41½	46½
27½	—15½	37	10½	17,200	Am. Solvents & Chemical	15½	16½	12	..
33¼	—15½	45½	15	200,700	Anglo-Chile Nitrate	21½	23½	18	18
..	..	49½	18½	376,700	Archer-Daniels-Midland	26½	28½	23½	24½
21½	—18½	27½	1½	103,000	Assoc. Dyeing & Printing	3½	3½	1½	2½
115	—31½	140	67	340,100	Atlas Powder	81	96½	78	83½
22	— 7½	32½	12½	1,352,200	Beacon Oil	17½	17½	12½	14½
98	—38	101	45	193,000	Beechnut Packing	62	65	57½	60
94½	—24½	89½	70	74,700	Bon Ami A	...	74½	70½	70½
..	..	34½	25	1,210	California Petroleum	..	28	28	28
53½	—19½	57½	20	158,100	Celanese	28½	37	28½	33½
117	—32½	122	80	45,100	Celanese, pf	89	99	82½	..
28½	—15½	32	10½	373,100	Certainteed	13½	16½	10½	13
49½	—24½	50	25	95,700	Chickasha Cotton Oil	28	28½	25	25½
..	..	90	..	122,600	Colgate-Palmolive-Peet	..	..	..	51½
239	..	63	20½	2,335,000	Commercial Solvents	29	35½	25½	31½
90½	1½	126½	70	2,131,700	Corn Products	90½	101	86½	92½
59½	—30½	69½	21½	1,170,600	Davison Chemical	28½	35	26½	29½
57	—23½	64½	24	187,800	Devoe & Raynolds	..	38½	31	33½
..	— 5½	115½	102	2,800	Devoe & Raynolds, pf	102	107½	102	106½
504	..	231	80	2,285,800	Du Pont	110½	128½	108	117
117½	— 1½	119½	107½	93,100	Du Pont, 6 pc. deb	115½	119	115	116½
181½	— 3½	264½	150	839,200	Eastman Kodak	180	199½	168½	177½
..	..	41½	27	26,700	Firestone Tire	35½	37	24½	26½
16½	—13	20½	2½	1,973,800	Fisk Rubber	4	4½	2½	3½
50½	—11½	54½	23½	988,300	Freeport Texas	35½	39½	33½	39½
37½	— 4½	64½	26	1,520,900	Glidden Co	36½	39	31½	33
104	— 2½	106½	95	10,100	Glidden Co., pf	..	103	102½	101½
..	..	82	31½	6,817,000	Gold Dust	41	45½	30½	40
105½	—63½	105½	38½	1,987,200	Goodrich Co	45	53	38½	42
..	..	130	80	6,500	Hercules Powder	84½	87½	84½	87½
100	—43	109	23	1,048,900	Houston Oil	48½	64	47½	57
121	— 3½	135	68½	162,100	Industrial Rayon	88	117½	83	117½
15½	—10½	17½	4	221,700	Int. Ag. Chemical	4½	5½	4	4½
84½	—29½	88½	40	28,100	Int. Ag. Chemical, pf	49	55½	48½	55
31	— 3½	44½	20	632,800	International Paper, A	29½	31½	25½	27½
...	12	90½	55½	18,700	International Salt	62	68	61	68
23½	—20½	24	3	1,542,300	Kelly-Springfield	4½	5	3	3½
23½	—17½	25	5	290,200	Lee Rubber & Tire	7½	7½	5½	6
181	..	43	17	150,500	Libby-Owens	21	22	19½	19½
109½	..	113½	40	666,300	Liquid Carbonic	53½	58½	49½	56½
181	..	72½	29	951,500	Mathieson Alkali	40	44½	34½	39½
...	..	80½	47	72,000	Monsanto Chemical	49½	55	47	49
39	— 9	58	15	1,074,800	Nat'l Distillers Products	35	38	28	30
132½	1½	210	129½	271,200	National Lead	140	157	133½	134½
289	..	87½	...	111,600	New Jersey Zinc	69½	70	65½	...
73½	— 2½	79½	...	300,500	Ohio Oil	70½	71½	70	71½
81½	..	98½	43	221,000	Owens-Ill. Glass	...	59½	50	53
45	—10	47	24½	1,451,800	Phillips Petroleum	38	40	31½	35
74½	..	76½	...	45,300	Pittsburgh Plate Glass	55	55	49	54
63½	— 4½	85	...	54,700	Pratt & Lambert	...	64½	58½	58½
..	..	98	..	29,300	Procter & Gamble	..	..	..	54
27	— 2½	30½	20	2,231,300	Pure Oil	23½	24½	22	24½
..	— 2	105½	75½	8,100	Sherwin-Williams	..	84	84	..
23½	— 4½	48½	14½	559,200	Silica Gel	14½	26½	14½	17½
42½	—18	45	21	5,958,000	Sinclair Oil	26½	28½	22½	24½
35½	— 3½	46½	28	1,896,300	Skelly Oil	33½	34½	30	31½
71½	—10½	81½	51½	3,665,200	Standard Oil, Cal	62	66½	59½	61½
54½	11½	83	48	15,050,200	Standard Oil, N. J	63½	69½	59½	66½
45½	—11½	48½	31½	7,188,700	Standard Oil, N. Y	34½	36½	31½	33½
4½	— 2½	9½	1½	196,200	Standard Plate Glass	2½	2½	1½	1½
65½	— 9½	86½	55	177,300	Sun Oil	60	62	55	56½
...	—10½	18	5½	3,100	Swan & Finch	...	8½	5½	...
19½	— 6½	20½	9½	1,051,000	Tennessee Copper & Chemical	12½	14½	12½	13
67½	—11½	71½	50	2,761,700	Texas Corporation	56½	59½	53½	56½
79½	—24	85½	42½	4,003,200	Texas Gulf Sulphur	57½	59½	51½	54½
21½	— 1½	40	14	133,700	Tidewater Oil	..	22½	20½	20
520	—380	550	111	27,162,500	Tubize Silk	155	182	135	140
199	..	140	59	5,224,900	Union Carbide	80	88	69	79
51½	— 5½	57	42½	867,500	Union Oil, Cal	45	47½	43½	45½
..	..	48½	15½	89,800	United Piece Dye	22½	24½	21	24
131	6	243½	95	2,267,800	U. S. Ind. Alcohol	140½	155½	123½	137
33½	—25½	35½	5	327,500	U. S. Leather	10	10½	6½	7½
48½	—24½	65	15	4,142,400	U. S. Rubber	26½	31½	22½	24
109½	—11½	133½	75½	569,600	Vacuum Oil	95	101½	94½	94½
103	—52½	116½	37½	1,915,600	Vanadium Corp	51	61½	44½	50½
84½	..	51½	33	237,400	Vick Chemical	36½	40½	35½	40
18½	—13	24½	3½	685,700	Va. Car. Chemical	5½	6½	5½	5½
59½	—31½	65½	15	177,500	Va. Car. Chemical, pf	...	30	25½	28½
96½	..	48	20	200,300	Wesson Oil	26½	26½	22	23½
12½	— 8½	13½	3	116,600	Wilson & Co	4	4½	3	3½

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Jan. 13.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.11 -$0.12	$0.11 -$0.12	$0.14 -$0.15
Acid, acetic, 28%, bbl., cwt.	3.88 - 4.03	3.88 - 4.03	3.38 - 3 63
Boric, bbl, lb.	.06½- .07	.06½- .07	.06½- .07
Citric, kegs, lb.	.46 - .47	.46 - .47	.46 - .47
Formic, bbl, lb.	.10½- .11	.10½- .11	.10½- .11
Gallic, tech., bbl., lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb, lb.	.06 - .07	.06 - .07	.06 - .07
Latic, 44%, tech., light, bbl., lb.	.11½- .12	.11½- .12	.12 - .12½
22%, tech., light, bbl., lb.	.05½- .06	.05½- .06	.05½- .06
Muriatic, 18°, tanks, cwt.	1.00 - 1.10½	1.00 - 1.10	.85 - .90
Nitric, 36°, carboys, lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -	18.00- 20.00
Oxalic, crystals, bbl., lb.	.11½- .11½	.11½- .11½	.11 - .11½
Phosphoric, tech., c'bys., lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks, ton	11.00 -11.50	11.00 -11.50	11.00 -11.50
Tannic, tech., bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl., lb.	.38½- .39	.38½- .39	.38 - .39
Tungstic, bbl., lb.	1.40 - 1.50	1.40 - 1.50	1.00 - 1.20
Alcohol, ethyl, 190 p'f., bbl., gal.	2.63 -	2.68½- 2.71	2.68½- 2.71
Alcohol, Butyl, tanks, lb.	.16½- .17	.16½- .17	.19 - .19½
Denatured, 190 proof			
No. 1 special dr., gal.	.51 -	.51 -	.48 -
No. 5, 188 proof, dr., gal.	.50 -	.51 -	.48 -
Alum, ammonia, lump, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl., lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl., lb.	.03 - .03½	.03 - .03½	.02½- .03½
Aluminum sulphate, com., bags, cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1 45
Iron free, bg., cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2 10
Aqua ammonia, 26°, drums., lb.	.03 - .04	.03 - .04	.03 - .04
Ammonia, anhydrous, cyl., lb.	.15 -	.14 -	.13½-
Ammonium carbonate, powd. tech., casks, lb.	.12 - .13	.12 - .13	.12 - .13
Sulphate, wks., cwt.	2.10 -	2.10 -	2 40 -
Amylacetate tech., drums, gal.	1.70 - 1.90	1.70 - 1.90	1.75 - 2.00
Antimony Oxide, bbl., lb.	.09 - .10	.09 - .10	.09 - .10
Arsenic, white, powd., bbl., lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs., lb.	.09½- .10	.09 - .10	.09 - .10
Barium carbonate, bbl., ton	58 00 -60 00	58 00 -60 00	57.50 -60 00
Chloride, bbl., ton	63 00 -65 00	65 00 -67.00	64.00 -70.00
Nitrate, cask, lb.	.07 - .07½	.07½- .08	.08 - .08½
Blanc fixe, dry, bbl., lb.	.03½- .04	.03½- .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl., lb.	.033- .033	.033- .033	.02½- .03
Bromine, cs., lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags., cwt.	4.50 -	4.50 -	4.50 -
Arsenate, dr., lb.	.07 - .08	.07 - .10	.06½- .07
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks., ton.	22 50 -	20 00 -	20.00 -
Phosphate, bbl., lb.	.08 - .08½	.08 - .08½	.07 - .07½
Carbon bisulphide, drums, lb.	.05 - .06	.05 - .06	.05 - .06
Tetrachloride drums, lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks., lb.	.02½-	.02½-	.03 -
Cylinders	.04½- .06	.04½- .06	.05 - .08
Cobalt oxide, cans, lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks., ton.	15 00 -16 00	15 00- 16.00	16.00 -17.00
Copper carbonate, bbl., lb.	.13 - .20	.13 - .20	.17 - .18
Cyanide, tech., bbl., lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl., cwt.	5 50 - 6.00	5.50 - 6.00	5.30 - 5.50
Cream of tartar, bbl., lb.	.26½- .27	.26½- .27	.27½- .28
Diethylene glycol, dr., lb.	.10 - .15	.10 - .15	.10 - .15
Epsom salt, dom., tech., bbl., cwt.	1.75 - 2 15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags, cwt.	1.15 - 1.25	1.15 - 1.25	1.15 - 1.25
Ethyl acetate, drums, bl.	1 02 -	10.9 -	12.5 -
Formaldehyde, 40%, bbl., lb.	.07½- .08	.08½- .09	.09½- .10
Furfural, dr., lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums, gal.	1.30 - 1.40	1.30 - 1.40	1.30 - 1.40
Refined, dr., gal.	1.90 - 2.00	1.90 - 2.00	2.50 - 3.00
Galubers salt, bags, cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, c.p., drums, extra., lb.	.14 - .14½	.14 - .14½	.14 - .15
Lead:			
White, basic carbonate, dry casks, lb.	.08½-	.09 -	.08½-
White, basic sulphate, sck., lb.	.08 -	.08½-	.07½-
Red, dry, sck., lb.	.09½-	.09½-	.09½-
Lead acetate, white crys., bbl., lb.	.13 - .14	.13 - .14	.13 - .13½
Lead arsenate, powd., bbl., lb.	.14 - .15	.13 - .14	.12 - .13
Lime, chem., bulk, ton	8.50 -	8.50 -	8.50 -
Litharge, pwd., csk, lb.	.08½-	.08½-	.08½-
Lithopone, bags, lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags, lb.	.06 - .06½	.06 - .06½	.06½- .07
Methanol, 95%, tanks, gal.	.58 -	.58 -	.55 -
97%, tanks, gal.	.60 -	.60 -	.55 -
Nickel salt, double, bbl., lb.	.13 - .13½	.13 - .13½	.10 - .11
Single, bbl., lb.	.13 - .13½	.13 - .13½	.10½- .11½
Orange mineral, csk., lb.	$0.11½-	$0.11½-	$0.11½-
Phosphorus, red, cases, lb.	.42 - .44	.42 - .44	.62 - .65
Yellow, cases, lb.	.31 - .32	.31 - .32	.32 - .33
Potassium bichromate, casks, lb.	.09 - .09½	.09 - .09½	.09 - .09½
Carbonate, 80-85%, calc., csk., lb	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd., lb.	.08½- .09	.08½- .09	.06½- .07
Cyanide, cs., lb.	.52 - .55	.52 - .55	.51 - .53
First sorts, csk., lb.	.08½- .09	.08½- .09	.08½- .09
Hydroxide (caustic potash) dr., lb.	.06½- .06½	.06½- .06½	.07½- .07½
Muriate, 80% bgs., ton	36 75 -	36.75 -	36.40 -
Nitrate, bbl., lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums, lb.	.16 - .16½	.16 - .16½	.15 - .16
Prussiate, yellow, casks, lb.	.18½- .19½	.18½- .19	.18 - .19
Sal ammoniac, white, casks, lb.	.046- .05	.046- .05	.047- .05
Salsoda, bbl., cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk, ton	22.00 -24.00	22.00 -24.00	15.00 -17.00
Soda ash, light, 58%, bags, contract, cwt.	1.32 -	1.32 -	1.32 -
Dense, bags, cwt.	1.35 -	1.35 -	1.35 -
Soda, caustic, 76%, solid, drums, contract, cwt.	2.90 - 3.00	2.90 - 3.00	2.90 - 3.00
Acetate, works, bbl., lb.	.04½- .05	.05 - .05½	.05½- .06
Bicarbonate, bbl., cwt.	2.00 - 2 25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks, lb.	.07 - .07½	.07 - .07½	.07 - .07½
Bisulphate, bulk, ton	16.00 -18 00	16.00 -18.00	3.00 - 3.50
Bisulphite, bbl., lb.	.03½- .04	.03½- .03½	.03½- .04
Chlorate, kegs, lb	.07½- .08	.07½- .08	.06½- .06½
Chloride, tech., ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom., lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl., lb.	.08½- .09½	.08½- .09½	.08½- .09
Hyposulphite, bbl., lb.	2 40 - 2.50	2.40 - 2.50	2.50 - 3.00
Nitrate, bags, cwt.	2.10 -	2 10 -	2.15 -
Nitrite, casks, lb.	.07½- .08	.07½- .08	.07½- .08
Phosphate, dibasic, bbl., lb.	.03½- .03½	.03½- .03½	.03½- .03½
Prussiate, yel. drums, lb.	.11½- .12	.11½- .12	.11½- .12
Silicate (30°, drums), cwt.	.70 - .80	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr., lb.	.02½- .03½	.02½- .03	.03½- .04
Sulphite, cyrs., bbl., lb.	.03 - .03½	.02½- .03	.02½- .03
Strontium nitrate, bbl., lb.	.03 - .03½	.03 - .03½	.02 - .03½
Sulphur, crude at mine, bulk, ton	18.00 -	18.00 -	18.00 -
Chloride, dr., lb.	.05 - .06	.04 - .05	.04 - .05
Dioxide, cyl., lb.	.07 - .08	.07 - .08	.09 - .10
Flour, bag, cwt.	1.55 - 3.00	1.55 - 3.00	1.55 - 3.00
Tin bichloride, bbl., lb.	.13 -	.13½-	.15½-
Oxide, bbl., lb.	.42 -	.42 -	.54 -
Crystals, bbl., lb.	.32 -	.32½-	.37½-
Zinc chloride, gran., bbl., lb.	.06½- .06½	.06½- .06½	.06½- .06½
Carbonate, bbl., lb.	.10½- .11	.10½- .11	.10 - .11
Cyanide, dr., lb.	.41 - .42	.40 - .41	.40 - .41
Dust, bbl., lb.	.08 - .08½	.08½- .09	.09 - .10
Zinc oxide, lead free, bag, lb.	.06½-	.06½-	.06½-
5% lead sulphate, bags, lb.	.06½-	.06½-	.06½-
Sulphate, bbl., cwt.	3 00 - 3 25	2.75 - 3.00	2.75 - 3.00

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.12½-$0.13	$0.12½-$0.13	$0.13½-$0.14
Chinawood oil, bbl., lb.	.13½-	.14½-	.14½-
Coconut oil, Ceylon, tanks, N.Y., lb.	.07½-	.07 -	.08½
Corn oil crude, tanks, (f.o.b. mill), lb.	.07½-	.08 -	.08½-
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.07 -	.07½-	.08½-
Linseed oil, raw, car lots, bbl., lb.	.14 -	.149 -	10 -
Palm, Lagos, casks, lb.	.07½-	.07½-	.09½
Niger, casks, lb.	.07 -	.07½-	.09 -
Palm Kernel, bbl., lb.	.07½-	.07½-	.09½-
Peanut oil, crude, tanks (mill), lb.	.07½-	.07½-	.10 -
Rapeseed oil, refined, bbl., gal.	.71 - .73	.71 - .73	.83 - .85
Soya bean tank (f.o.b. Coast), lb	.09½-	.10½-	.10 -
Sulphur (olive foots), bbl., lb.	.08½-	.08 -	.10½-
Cod, Newfoundland, bbl., gal.	.59 - .60	.57 - .68	.65 - .67
Menhaden, light pressed, bbl., gal.	.67 - .70	.64 - .66	.60 - .61
Crude, tanks (f.o.b. factory), gal.	.45 -	.45 -	.48 -
Whale, crude, tanks, gal.	.78 -	.80 -	-
Grease, yellow, loose, lb.	.06½-	.06½-	.07½-
Oleo stearine, lb.	.11½-	.11½-	.09½-
Red oil, distilled, d.p. bbl., lb.	.10½- .11	.09½- .10	.09½- .09½
Tallow, extra, loose, lb.	.07½-	.07½-	.08½-

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.85 - .90
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.35 - .36
Aniline oil, drums, extra, lb.	.15 - .15½	.14½- .15	.15 - .16
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums, lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr., lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl., lb.	.65 - .67	.65 - .67	.70 - .72
Benzoic acid, U.S.P., kgs, lb.	.57 - .60	.57 - .60	.58 - .60
Benzyl chloride, tech., dr., lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works, gal.	.23 - .25	.23 - .25	.22 - .23
Beta-naphthol, tech., drums, lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr., lb.	.14 - .17	.14 - .17	.18 - .20
Cresylic acid, 97%, dr., wks., gal.	.73 - .75	.70 - .72	.73 - .75
Diethylaniline, dr., lb.	.55 - .58	.55 - .58	.58 - .60
Dinitrophenol, bbl., lb.	.30 - .32	.30 - .31	.31 - .35
Dinitrotoleun, bbl., lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr., gal.	.26 - .28	.26 - .28	.28 - .30
Diphenylamine, bbl., lb.	.42 - .44	.42 - .43	.45 - .47
H-acid, bbl., lb.	.68 - .70	.65 - .70	.63 - .65
Naphthalene, flake, bbl., lb.	.04½ - .05	.04½ - .05	.05 - .06
Nitrobenzene, dr., lb.	.09 - .10	.09 - .10	.08½ - .10
Para-nitraniline, bbl., lb.	.51 - .55	.55 - .56	.52 - .53
Para-nitrotoluine, bbl., lb.	.28 - .31	.29 - .31	.28 - .32
Phenol, U.S.P., drums, lb.	.13½ - .14	.13½ - .15	.15 - .17
Picric acid, bbl., lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., lb.	1.75 - 1.90	1.75 - 1.90	1.35 - 1.50
R-salt, bbl., lb.	.44 - .45	.44 - .45	.47 - .49
Resorcinal, tech., kegs, lb.	1.25 - 1.30	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl., lb.	.33 - .35	.30 - .32	.30 - .32
Solvent naphtha, w.w., tanks, gal.	.30 - .35	.30 -	.35 - .....
Tolidine, bbl., lb.	.91 - .903	.86 - .90	.95 - .96
Toluene, tanks, works, gal.	.40 - ...	.45 - ...	.35 - ...
Xylene, com., tanks, gal.	.30 - .35	.30 - .35	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl., lb.	.14½ - .15	.15½ - .16	.16½ - .17
China clay, dom., f.o.b. mine, ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.06 - .13	.06 - .13	.06½ - .07
Prussian blue, bbl., lb.	.35 - .36	.35 - .36	.31 - .32
Ultramine blue, bbl., lb.	.06 - .32	.06 - .32	.08 - .35
Chrome green, bbl., lb.	.27 - .28	.27 - .28	.27 - .30
Carmine red, tins, lb.	6.00 - 6.50	6.00 - 6.50	5.25 - 5.50
Para toner, lb.	.75 - .80	.75 - .80	.70 - .80
Vermilion, English, bbl., lb.	1.90 - 2.00	1.90 - 2.00	1.80 - 1.85
Chrome yellow, C. P., bbl., lb.	.17 - .17½	.17 - .17½	.15½ - .16
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	5.75 - 7.00
Graphite, Ceylon, lump, bbl., lb.	.04 - .05	.04 - .05	.08 - .09
Cum copal Congo, bags, lb.	.07¼ - .08	.07¼ - .08	.07¼ - .08
Manila, bags, lb.	.16 - .17	.16 - .17	.15 - 18
Damar, Batavia, cases, lb.	.21 - .22	.21 - .22	.22 - .23
Kauri No. 1 cases, lb.	.45 - .50	.48 - .53	.48 - .53
Kieselguhr (f.o.b. N. Y.), lb.	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton	40.00 -.....	40.00 -.....	40.00 -.....
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	8.70 -.....	8 60 -.....	9.50 -.....
Turpentine, gal.	.56½ -.....	.54 -.....	.59 -.....
Shellac, orange, fine, bags, lb.	.59 - .60	.59 - .60	.61 - .62
Bleached, bonedry, bags, lb.	.46 - .48	.46 - .48	.56 - .60
T. N. bags, lb.	.33 - .35	.35 - .36	.46 - .47
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10 00 -12.00	10 00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton	9.50 -.....	9.50 -.....	10.50 -.....
300 mesh (f.o.b. Ga.), ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton	13 75 - ...	13.75 - ...	13.75 -... 1

	Current Price	Last Month	Last Year
Wax, Bayberry, bbl., lb.	$0.27 -$0.29	$0.28 -$0.31	$0.31 -$0.32
Beeswax, ref., light, lb.	.37 - .39	.38 - .40	.41 - .42
Candelilla, bags, lb.	.21 - .23	.22 - .23	.23 - .24
Carnauba, No. 1, bags, lb.	.32 - .33	.33 - .34	50 - .51
Paraffine, crude 105-110 m.p., lb.	.04¼ - .05	.04¼ - .05	.04¼ - .05

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferromanganese, 78-82%, ton	100.00-.....	105 00-.....	105 00-.....
Spiegeleisen, 19-21%, ton	33.00-.....	33 00-.....	32.00-.....
Ferrosilicon, 14-17%, ton	45.00-.....	45.00-.....	45.00-.....
Ferrotungsten, 70-80%, lb.	1 45.....	1.45-.....	1.35- .98
Ferro-uranium, 35-50%, lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%, lb.	3.15- 3.75	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb.	$0.17½-.....	$0.18 -.....	$0.16½-.....
Aluminum, 96-99%, lb.	.24 - .30	.24 - .26	.24 - .25
Antimony, Chin. and Jap., lb.	.08¼-.....	.08¼-.....	.09¼-.....
Nickel, 99%, lb.	.35 -.....	.35 -.....	.35 -.....
Monel metal, blocks, lb.	.28 -.....	.28 - .28	.28 -.....
Tin, 5-ton lots, Straits, lb.	.39½-.....	.41½-.....	.49 -.....
Lead, New York, spot, lb.	.06½-.....	.06¼-.....	.06½ -.....
Zinc, New York, spot, lb.	.056-.....	.06 -.....	.067 -.....
Silver, commercial, oz.	.45½-.....	.49½-.....	.57½-.....
Cadmium, lb.	.85 - .95	.85 - .95	70 - .80
Bismuth, ton lots, lb.	1 70 -.....	1.70 -.....	1 70 -.....
Cobalt, lb.	2.10 - 2.50	2.10 - 2.50	2 50 -.....
Magnesium, ingots, 99%, lb.	.85 - 1.10	.85 - 1.10	.85 - 1.10
Platinum, ref., oz.	62 00- 66.00	65.00- 66.00	70.00-70.00
Palladium ref., oz.	35 00- 36.00	35.00- 36.00	42.00-46.00
Mercury, flask, 75 lb.	123.50-.....	124.00-	122.00-.....
Tungsten powder, lb.	1.35- 1.50	1.35- 1.50	1.10- 1.15

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton	$7.50- $8.00	$7.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post, ton	21.50- 25.00	21.50- 25.00	22.00- 23 00
Coke, fdry., f.o.b. ovens, ton	2.75- 2 85	2.75- 3.85	2.85- 3.00
Fluorspar, gravel, f.o.b. Ill., ton	18.00- 20.00	18.00- 20.00	17.00-18.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit	.31 - .36	.31 - .36	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb.	.48 - .50	.48 - .50	.48- .50
Monazite, 6% of ThO_2, ton	60.00-.....	60.00-.....	130.00-.....
Pyrites, Span. fines, c.i.f., unit	.13 -.....	.13 -.....	.13 -.....
Rutile, 94-96% TiO_2, lb.	.10 - .11	.10 - .11	.11 - .13
Tungsten, scheelite, 60% WO_3 and over, unit	15 25- 16.50	15.25 -16.50	11.25 -11.50
Vanadium ore, per lb. V_2O_5, lb.	28.00-.....	.28 -.....	nom. - nom.
Zircon, 99%, lb.	.03 -.....	.03 -.....	.03 -.....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Alloy Factory — Driver-Harris Co., Middlesex St., Harrison, N. J., is having plans prepared for the construction of a 1 and 2 story addition to factory for the manufacture of alloys for electrical resistance and castings for connecting, carbonizing, hardening and tempering. Estimated cost $250,000. J. A. Finegan, 776 Broad St., Newark, is architect.

Aluminum Plant—Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa., plans to expend $50,000,000 in 1930. Allocation under the budget heading has not been completed but a considerable portion of this sum will be spent in Pittsburgh district.

Aluminum and Bronze Factory—Springfield Bronze & Aluminum Co., Page Blvd., Springfield, Mass., awarded contract for the construction of a 1 story, 85 x 145 ft. factory to Austin Co., 16112 Euclid St., Cleveland, O. Estimated cost $45,000.

Battery Plant — Wubco Battery Co., J. L. Rupp, Braddock Ave., Swissvale, Pa., will soon award contract for the construction of a 1 story battery plant at McCague and Irvine Sts. Estimated cost $200,000. Electric Auto Lite Co., Champlain and Mulberry Sts., Tolelo, O., is engineer.

Cameras, Etc. — Eastman Kodak Co., 643 South Hill St., Los Angeles, Calif., awarded contract for the construction of a 2 story, 35 x 131 ft. factory at 1117 North Las Palmas Ave. to H. A. McMurphy, 6347 Eleanor Ave., Los Angeles. Estimated cost $100,000.

Film Manufacturing Plant—Attica Film Corp., 544 West 43rd St., New York, N. Y., plans the construction of a film manufacturing plant at 548 West 43rd St. Estimated cost $40,000. R. L. Senior, 142 East 43rd St., New York, is architect.

Carbonic Factory.— Liquid Carbonic Corp., 3100 South Kedzie Ave., Chicago, Ill., awarded contract for the construction of a factory on Hostetter St., Los Angeles, Calif. to The Austin Co. of California, 777 East Washington St., Los Angeles, Calif. Estimated cost $100,000.

Carbonic Gas Plant—Crystal Carbonic Laboratory, W. N. Cochran, V. Pres. and Gen. Mgr., subsidiary of Coca Cola Co., 2019 North Lamar St., Dallas, Tex., plans the construction of a plant for the manufacture and compression of carbonic gas, used in carbonate beverages at Alamo and Wichita Sts., North Dallas.

Cement Plant — Canada Cement Co. Ltd., Phillips Sq., Montreal, Que., plans the construction of storage bins and packing plant in connection with cement plant at St. John, N. B. Estimated cost $300,000.

Celluloid Plant—Bachman Bros. Inc., 609 Commerce St., Philadelphia, Pa., awarded contract for the construction of a 2 story, 110 x 220 ft. celluloid factory at Erie and M Sts. to A. R. Raff Co., 1635 West Thompson St., Philadelphia. Estimated cost $200,000.

Chemical Plant—American Potash & Chemical Corp., 233 Broadway, New York, N. Y., plans large plant expansion. Estimated cost $6,000,000. Maturity indefinite.

Chemical Plant—Beckwith-Chandler Co., 201 Emmett St., Newark, N. J., will soon award contract for the construction of a plant for the manufacture of pyroxylin and other chemicals and compositions. Estimated cost $100,000.

Chemical Plant—Floyd L. Carlisle & Co., 15 Broad St., New York, N. Y., plans the construction of a chemical plant at Oswego. Maturity late 1930.

Chemical Plant Addition—Wallace & Tiernan Co., Inc., 11 Mill St., Belleville, N. J., is having sketches made for addition to factory for the manufacture of chlorine control apparatus. Estimated cost $40,000. Fletcher Thompson Inc., 542 Fairfield Ave., Bridgeport, Conn., is architect.

Tooth Paste Factory—Iodent Chemical Co., 1011 Lafayette Blvd., Detroit, Mich., is having plans prepared for the construction of a 2 story tooth paste factory. Estimated cost $200,000. Private plans. Complete equipment will be required.

Cream of Tartar Factory—S. Castorina, Lodi, Calif., is having plans prepared for the construction of a 4 story plant for the manufacture of cream of tartar, $200,000, also additional unit to present distillery plant. A. C. Martin, Higgins Bldg., Los Angeles, is architect.

Coke Ovens—Colorado Fuel & Iron Co., A. Raeder, Pres., Boston Bldg., Denver, Colo., will soon receive bids for addition of 42 coke ovens to plant at Pueblo. Estimated cost $1,000,000.

Coking Plant—Dominion Natural Gas Co., Caledonia Rd., Hamilton, Ont., is having studies made by Semet Solvay Co., 61 Broadway, New York, N. Y., Engrs., for the construction of a coking plant at Port Stanley. Estimated cost $3,000,000.

Creosoting Plant—American Creosote Works Inc., 1305 Dublin St., New Orleans, La., will receive bids early in January for the construction of a large creosoting plant including two high pressure creosoting cylinders 8 x 150 ft. together with necessary tram cars, power plant and engine room equipment, etc. at Jackson, Tenn.

Creosoting Plant—National Lumber & Creosoting Co., 5601 Fox St., Denver, Colo., will build a plant for treating telephone and telegraph poles at Laramie, Wyoming. Estimated cost $40,000. Work will be done by day labor.

Drying Oven Building—Multibestos Co., South St., Walpole, Mass., is having revised plans prepared for the construction of a 2 story, 36 x 80 ft. addition to drying oven building. Estimated cost to exceed $40,000. Lockwood Greene Engrs. Inc., 24 Federal St., Boston, are engineers.

Enameling Plant—Youngstown Pressed Steel Co., W. W. Galbreath, Pres., Warren, O., awarded contract for the construction of a 1 story, 60 x 382 ft. enameling plant to The Austin Co., 16112 Euclid Ave., Cleveland. Estimated cost $50,000.

Gas Plant—Semet Solvay Co., 61 Broadway, New York, N. Y., Engrs., are receiving bids for sub-contracts, equipment, etc., for re-equipping and alterations to gas plant at New London, Conn., for Connecticut Power Co., 33 Union St., New London. Estimated cost $30,000.

Gas Plant, Etc.—Mississippi Gas Co., c/o T. Rice, Laurel Gas Co., Laurel, Miss., plans the construction of a draught water gas plant, also high pressure distribution system at McComb to cost $250,000. Private plans.

Gas Plant Addition—Public Utilities Commission, V. S. McIntyre, Mgr., Kitchener, Ont., plans addition to gas plant. Estimated cost $27,000.

Glass Plant—Oil City Glass Bottle Co., R. R. Underwood, Pres., Marienville, Pa., subsidiary Knox Glass Bottle Co., plans the construction of a 1 story, 50 x 200 ft. glass plant at Oil City. Private plans.

Iron Oxide Manufacturing Plant—Sherwin Williams Co., 601 Canal St., Cleveland, O., is having plans prepared for the construction of an iron oxide manufacturing plant. Estimated cost to exceed $150,000. Private plans.

Pigment Plant—Bildoe Corp., H. H. Webber, Pres., Laurel, Miss., plans the construction of a purified iron-oxide mined pigment plant, 100 ton daily capacity.

Chemistry Annex—University of Illinois, Chicago, Ill., will soon award contract for the construction of a chemistry annex. $335,000. J. M. White is supervising architect. Also plans a medical and dental laboratory. $1,500,000.

Laboratory (Chemistry)—Bd. of Education, Chillicothe, O., plans issuing $480,000 bonds for the construction of a high school, including chemistry laboratory Garber & Woodward, 4 West Seventh St., Cincinnati, are architects.

Laboratory (Chemistry)—Indiana University, Bloomington, Ind., will receive bids until Jan. 31 for the construction of a college building including chemistry laboratory on Campus. Estimated cost $350,000. R. F. Daggett, 922 Continental Bank Bldg., Indianapolis, is architect.

Laboratory (Chemical)—Mount Holyoke College, M. E. Woolley, Pres., South Hadley, Mass., is having preliminary sketches made for the construction of a memorial library, physical and chemical laboratory, etc. G. F. Newton, 6 Beacon St., Boston, is engineer.

Laboratory — Bd. of Higher Education, St. Nicholas Terrace, New York, N. Y., will receive bids about Feb. 1 for the construction of a 4 story, 130 x 213 ft. college including laboratory, unit 3 at Navy and Bedford Aves. Estimated cost $1,000,000. Thompson, Holmes & Converse and C. B. Meyer, 101 Park Ave., New York, are architects.

Laboratories — Bd. of Education, J. R. Sargent, Pres., Topeka, Kan., will receive bids until Jan. 30 for the construction of a 3 story, 53 x 300 ft. high school, including laboratories, etc., at Western Ave. and 10th St. Estimated cost $1,100,000. T. W. Williamson & Co., 312 Farmers National Bank Bldg., Topeka, are architects.

Laboratory, Pump House, etc.—Standard Oil Co., c/o E. B. Wagner, East Ohio Gas Bldg., Cleveland, O., awarded contract for a 30 x 70 ft. laboratory to A. M. Higley Co., Plymouth Bldg., Cleveland, and 22 x 103 ft. pump house to The Dresser Co., The Arcade, Cleveland. $40,000.

Leather Factory Addition—J. S. Barnet & Sons, 128 Boston St., Lynn, Mass., is having plans prepared for a 1 story, 50 x 200 ft. addition to leather factory at 128 Boston St. Estimated cost $40,000. C. L. Botton, 31 Exchange St., Lynn, is architect.

Leather Products Factory — Textile Leather Products Co., Newark, N. J., awarded contract for a 1 story, 100 x 500 ft. leather products factory on Stickney St., Toledo, O., to A. Bentley & Sons, Belmont Ave., Toledo. Estimated cost $500,000.

Linseed Oil Plant—Dominion Linseed Oil Co., Royal Bank Bldg., Toronto, Ont., plans to rebuild linseed oil plant at Owen Sound. Estimated cost $50,000 to $100,000. Private plans. Work largely by day labor.

Linseed Oil Press and Manufacturing Plant—Sherwin Williams Co., 601 Canal St., Cleveland, O., is having plans prepared for the construction of a linseed oil press and manufacturing plant. Estimated cost to exceed $100,000. Private plans.

Mill Building—The Vulcan Detinning Co., R. D. O'Neil, V. Pres., Neville Island, Pa., awarded contract for a 1 story, 105 x 402 ft. mill to The Austin Co., 493 Union Trust Bldg., Pittsburgh. Estimated cost $200,000. Entire project to be constructed over present plant, permitting work in plant to continue.

Mining Building, Crusher Plant and Transformer Building — International Nickel Co. of Canada, Ltd., Copper Cliffe, Ont., awarded contract for rebuilding mining building recently destroyed by fire to Fraser-Brace Engineering Co. Ltd., Craig St. W., Toronto. Estimated cost $250,000. Also plans crusher plant and transformer building destroyed by fire at Sudbury, Ont. Plans to immediately re-equip. $250,000.

INDUSTRIAL BUILDING CONTRACTS IN 1928 AND 1929
($40,000 or More.)

	1929		1928	
	No.	Value	No.	Value
Aircraft	31	$14,818	13	$4,361
Automotive*	291	28,962	244	37,181
Chemicals, Fine	5	665	8	1,580
Chemicals, Heavy	56	7,796	43	7,477
Other Process Industries	9	2,255	20	6,661
Clay and Brick Products	25	3,620	15	2,939
Coke	3	230	4	459
Cold Storage Warehouses	19	3,327	26	10,811
Other Warehouses	85	12,184	59	13,177
Electric Power Plants	164	151,033	118	64,273
Explosives	1	40	1	300
Fertilizer	2	300	1	100
Foundries	41	4,150	35	4,752
Glass	14	10,425	9	7,506
Iron and Steel Products	107	48,920	143	19,014
Leather Goods	12	1,284	11	1,481
Lime and Cement	6	2,255	6	2,304
Lumber and Woodworking	26	4,857	21	2,652
Machine Shops	103	13,850	67	10,303
Manufactured Gas	14	2,178	12	9,765
Oils, Vegetable and Animal	1	40	1	56
Paint and Varnish	10	505	16	1,275
Paper and Pulp	26	21,136	26	8,761
Petroleum Products	46	55,346	38	6,954
Printing and Binding	55	8,629	35	6,314
Pyroxylin Products	3	2,240	3	1,120
Radio	14	3,194	4	1,200
Rayon	3	660	5	20,240
Other Textiles	101	9,705	71	9,103
Rubber Products	35	9,273	20	3,473
Soap	6	1,700	2	140
Sugar	3	280	1	40
Other Food Products	246	31,858	200	32,917
Miscellaneous Factories	644	89,488	394	56,498
Total	2,207	$547,313	1,672	$355,187

*Automotive Plants and Service or Repair Garages.

Ovaltine Plant—A. Wander Ltd., 455 King St. W., Toronto, Ont., awarded contract for substructure of 3 story plant for the manufacture of ovaltine at Peterborough, Ont., to T. A. Brown Co. Ltd., Wolf St., Peterborough. Estimated cost $150,000.

Paint Manufacturing Plant—Corp., c/o H. Holder, 242 Franklin Ave., Brooklyn, N. Y., Archt. is having sketches made for the construction of a paint manufacturing plant. Estimated cost $800,000.

Paint and Varnish Factory—Pacific Paint & Varnish Co., 4th and Cedar Sts., Berkeley, Calif., plans addition to paint and varnish factory. Estimated cost to exceed $40,000.

Varnish Factory — McCloskey Varnish Co., 30th and Locust Sts., Philadelphia, Pa., will soon award contract for the construction of a 1 and 2 story, 82 x 229 ft. factory and warehouse at State Rd. and Rhawn St. Olsen & Kik, 117 South 10th St., Philadelphia, are architects.

Paper Box Factory—F. N. Burt & Co., 330 Bay St., Toronto, Ont., manufacturers of paper boxes, is having plans prepared for a 1 story, 175 x 350 ft. factory at Mount Dennis. Estimated cost $200,000. Earle Sheppard, 57 Queen St. W., Toronto, is architect.

Paper Mill—U. S. Envelope Co., R. J. Block, Lititz, Pa., plans the construction of a paper mill. Estimated cost $250,000. J. H. Wickershaw, Appel Bldg., Lancaster, Pa., is architect.

Phonograph Factory — Capehart Phonograph Co., Fort Wayne, Ind., awarded contract for a 160 x 160 ft. phonograph factory to Rump-Kintz Co., Fort Wayne. Estimated cost $100,000.

Mine Development — Southern Phosphate Corp., E. A. Pierce, Gen. Mgr., Ridgewood, Fla., plans to develop mine, also construct dryer and dry bins. Equipment to cost $500,000. L. J. Frost, c/o owner, is engineer.

Plant—Philfuel Co., Bartlesville, Okla., will build a plant including warehouse, pump house storage shed, central heating plant, etc. at Schenectady Rd. No. 25. Estimated cost $70,000. Work will be done by owner's forces. L. Morant, Tulsa, in charge.

Refinery (Oil)—Standard Oil Co. of New Jersey, 26 Broadway, New York, Atlantic Refining Co., 291 Broadway, and Gulf Oil Co., New York, N. Y., plans the construction of an oil refinery at Havre (Point Jerome), France. Estimated cost $1,000,000. Negotiations with French Government regarding settlement of oil importation quota in progress.

Refinery—Gulf Refining Co., Port Arthur, Tex., awarded contract for 32 high pressure gasoline cracking chambers for refinery under construction to A. O. Smith Co., 27th and Keefe Sts., Milwaukee, Wis. Estimated cost $1,000,000.

Refinery (Oil) — McCall-Frontenac Oil Co., 114 Don Esplanades St., Toronto, Ont., plans the construction of an oil refinery on Commissioners St. Estimated cost $200,000. Private plans.

Refinery (Oil)—Shell Co. of Canada, Federal Bldg., Toronto, Ont., plans the construction of an oil refinery at turning basin. Estimated cost $100,000. Private plans. Equipment will be required.

Refinery (Oil)—Union Oil Co. of Pennsylvania, 1170 Yonge St., Toronto, Ont., plans the construction of an oil refinery at Port Credit. Estimated cost $100,000. J. G. White Engineering Corp., 43 Exchange Pl., New York, is engineer.

Refineries (Oil)—Vacuum Oil Co., 61 Broadway, New York, N. Y., awarded contract for re-equipping and alterations to oil refineries at Bremen, Germany, Almos Suciot, Hungary, Kolin, Czecho-Slovakia, and Czechowice, Poland, to Foster Wheeler Corp., 165 Broadway, New York, N. Y. Estimated cost to exceed $200,000 each.

Refinery (Electrolytic), Ore Crushing and Concentrating Plant, etc.—Cerro de Pasco Copper Mining Co., 44 Wall St., New York, N. Y., is having plans prepared for the construction of an electrolytic refinery, also hydro-electric plant in vicinity of Cerro de Pasco and Oroya, Peru, $1,000,000 and $6,000,000 respectively; bids on separate contracts about Mar. 1 for ore crushing and concentrating plant at Oroya, $7,000,000; tunnels, timbering, excavation, etc., outlying mines from Cerro de Pasco. $1,000,000, work by day labor.

Roofing Products Factory—Barrett Co., 36th St. and Grays Ferry Ave., Philadelphia, Pa., manufacturers of roofing products, plans to rebuild plant unit recently destroyed by fire. Loss $400,000.

Lithopone Plant Addition—Ozark Smelting & Refining Co., c/o Sherwin-Williams Co., 601 Canal St., Cleveland, O., will receive bids in Feb. for addition to lithophone plant at Coffeyville, Kan. Estimated cost $300,000.

Smelter Plant—Stock or Co-Operative Co., c/o Chamber of Commerce, Marfa, Tex., plans the construction of an ore smelter plant at junction of Conchas and Rio Grande rivers at a point 4 mi. north of Presidio, Tex. Plans are being worked out to build the plant on a co-operative basis, each mining company investing according to ore it would bring to plant, etc. Estimated cost $3,000,000.

Maple Sugar Products Plant—J. A. Grenier, Deputy Minister, Dept. of Agriculture, Quebec, plans the construction of maple products plant in Eastern Township.

Tile Factory—Dunn Mfg. Co., c/o Chamber of Commerce, Brownwood, Tex., plans the construction of a factory for the manufacture of building tile of different sizes and purposes. Private plans.

Tile Manufacturing Plant—C. T. Pluckhahn & Associates, Dalhart, Tex., plans the construction of a tile manufacturing plant, 50,000 tiles per mo. capacity. Estimated cost $45,000.

Tin Foil and Metal Factory—Johnston Tin Foil & Metal Co., 6106 South Broadway, St. Louis, Mo., awarded contract for a 2 story, 100 x 104 ft. addition to factory to Gillespie & Daly Inc., 418 International Bldg., St. Louis.

Welding Plant — Beaird Corp., c/o J. B. Beaird, Shreveport, La., is having preliminary plans prepared for the construction of a welding plant. Estimated cost $250,000.